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INSTRUCTION BOOK

TANDEM PROCESSING SUBSYSTEM
(CONTROLLERS)

PART OF

FLIGHT SEVICE AUTOMATION SYSTEM

VOLUME V

CONTROLLED DOCUMENT

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Tape Driver Controller
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TANDEM

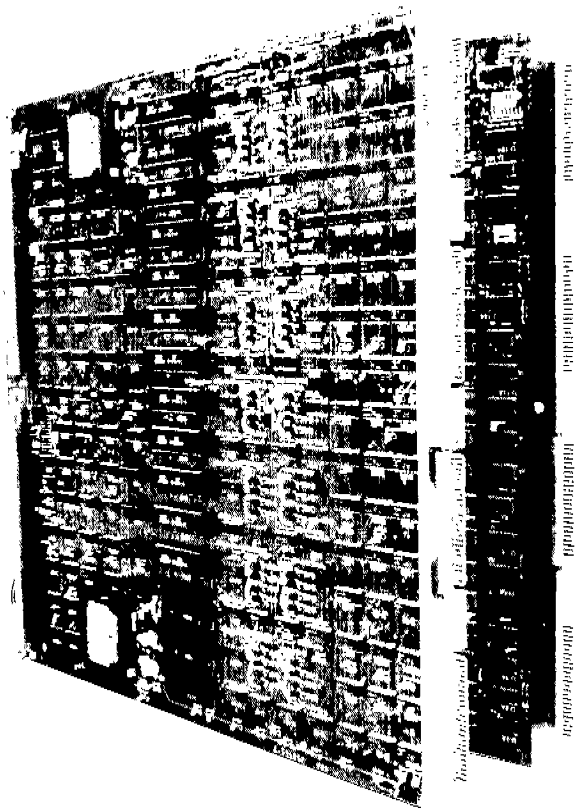
NonStop™ Systems Maintenance Manual

Asynchronous Controller and Extension T16/6303 and 6304

Fourth Level

NonStop 1+ System
NonStop Systems

6303/6304 ASYNCHRONOUS CONTROLLER AND EXTENSION



TANDEM COMPUTERS INCORPORATED
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Tandem Part Number 82831-A00

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WARNING

This equipment generates, uses, and can radiate radio frequency energy and, if not installed in accordance with the instructions manual, may cause interference to radio communications. It has been tested for compliance with the limits of Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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SECTION 1
INTRODUCTION

The 6303/6304 Asynchronous Controller allows you to connect asynchronous data communications lines, RS-232C or current loop character mode terminals and automatic-call units (ACUs) to a computer system.

With the 6303/6304 Asynchronous Controller, Tandem supports a wide variety of interactive terminals with different characteristics. The 6303/6304 hardware features the following:

- Up to 32 asynchronous ports
- Each data link individually configured for line speed, character size, parity, character stripping, and control characters
- Multiple line speeds from 50 bps to 19,200 bps
- RS-232C or current loop interfaces
- Byte read capability for controlling simultaneous low-speed terminals
- Transmission break and pause capability
- Support for Bell-equivalent 103, 113, 202, and 212 modems (including reverse channel) and for Bell 801C Automatic Calling Unit (ACU)

The 6303 controller provides most of the controller logic and two physical ports. Each 6304 Extension provides an additional 15 ports. In its maximum configuration the 6303/6304 controller occupies three controller positions of an I/O channel, requires two 7501 terminal patch panels, and provides up to 32 asynchronous ports.

In an asynchronous environment, the stations synchronize with one another by means of a start and stop bit attached to every character that passes over the line. The Asynchronous Controller automatically generates stop and start bits on output and strips them on input.

The asynchronous protocols use ASCII or ANSI EBCDIC control characters to define the nature of each transmission.

Each line may be configured independently to select the following characteristics: any of sixteen baud rates from 50 to 19.2k bps; 5-, 6-, 7-, or 8-bit character length; 1 or 2 stop bits; 20ma current loop, modem-connected, or hard wired EIA interface; echoplex enabled or disabled; parity enabled or disabled. Note that the character length does not include the start, stop, and parity bits.

With terminal and controller parity enabled, the controller generates and checks parity automatically for all data transfers to and from the device. Parity select may be odd, even, or none.

In addition, you can specify termination characters other than ETX, turnaround characters for use with half duplex modems, and end-of-text characters for delineating the text of a message.

The Asynchronous Controller may also be configured to support both conversational and page mode terminals. For conversational mode Terminals, you can specify the characters that serve as line terminators and indicate line deletion, backspace, and end-of-file. A carriage return/line feed delay gives time for mechanical terminals to return to the beginning of each line. A forms-control delay provides similar delays for form feeds. Because these delays can be configured individually, terminal operators at display terminals and other buffered terminals that need no such delays do not have to wait unnecessarily. For page mode terminals, you can specify the page termination character and pseudo-polling trigger character.

The Asynchronous Controller also provides character stripping for control character independence. You may configure the controller to strip any four characters of your choice.

The byte read capability makes it possible for you to control terminals that have no method of transmitting a beginning or end-of-message character. With such terminals, the computer must always be ready to accept data from them. The programmable byte read feature permits the 6303/6304 controller to accept unsolicited transmissions. Byte read is particularly important for controlling a large number of low-speed terminals simultaneously. It can be used with terminals that do not transmit an end-of-text delimiter or where a continuous read from a simplex terminal is necessary.

The transmission break capability allows you to put a constant space condition on the line. It is used primarily for telex lines where the quiescent state of the line is a space condition.

The transmission pause (T-Pause) capability is used with buffered hard-copy devices, such as printers with line buffers or terminals with short buffers. With this capability the remote devices can signal the controller that a pause is necessary to allow the device to print the current contents of its buffer.

1.1 SOFTWARE ENVIRONMENT

In a configured asynchronous data communications environment ENVOY comprises:

- One or more protocol procedures
- One or two driver procedures
- One or more ENVOY NonStop I/O process pairs
- The default ENVOY interrupt handler and/or one or more special interrupt handlers

The protocol procedures determine the valid message formats, the sequence in which line operations are to be performed, and the appropriate corrective action to be taken when a line error occurs. Tandem currently supports the Asynchronous Line Supervisor protocol.

The protocol and driver procedures are system code modules that can be shared within the same processor by more than one communications line.

Each ENVOY NonStop I/O process pair controls up to 32 lines on an 6303/6304 Asynchronous Controller. There is one such pair for each controller. An ENVOY I/O process accepts application program I/O requests by way of GUARDIAN file system procedure calls and, in turn, calls the protocol and driver procedures to perform the desired operations. For each line that it controls, an ENVOY I/O process procures the system buffer space necessary to complete an I/O request, remembers the current state of the line, and returns a completion status code (and data for input operation) to the application process.

The interrupt handler receives line interrupts from all configured asynchronous communication lines and routes them to the proper application process. Most of the available protocols use the standard ENVOY interrupt handler. Simplex and full duplex communications, however, necessitate the use of a special interrupt handler.

An application process functionally interacts with ENVOY by way of:

- GUARDIAN file system procedures
- GUARDIAN file system error codes (see Appendix D)
- Format of the message being transferred

1.2 LINE ERROR HANDLING BY ENVOY

During a transmission via a data communications line, there are certain "error" conditions that can be expected to occur. The occurrence of an error condition causes ENVOY to attempt recovery on behalf of the application process. Examples of these error conditions are:

- BCC (block check character) error when receiving
- NAK received when transmitting
- Incorrect ACK received when transmitting

Each separate error causes ENVOY to perform a predefined sequence of operations when attempting recovery.

To detect cases where line conditions present successful transmission of data and to detect a failed remote station, the following parameters are specified for each line at SYSGEN time.

- **Timeout:** This specifies a maximum time period that ENVOY allows for a line operation, intiated by a call to a file system procedure, to complete.

- **Retry Count:** This specifies the maximum number of times an operation that failed due to a line error or time out should be retried.

The total time period allowed for a line operation to complete is a function of the timeout period, the retry count, and the specific operation being performed. The responses by ENVOY to specific line errors and timeouts are described with each individual protocol.

1.3 ASYNCHRONOUS LINE SUPERVISOR

The asynchronous line supervisor protocol offers the following features:

- Data from the communication line is placed into memory one character at a time. The protocol then packs two characters in each word before passing text to the application process.

- The line interface performs optional character stripping. The line interface strips up to 4 characters (i.e., null, pad) so that they will not appear in the application's buffer. Optional termination on character recognition may also be specified, however, only a maximum of four characters may be specified for stripping or termination.

- Reads in continuous mode where the application receives data from a simplex line. The line interface passes data to the application when a buffer fills or when a defined timeout interval occurs on the line; i.e., all remaining data in the buffer will be passed at the detection of no input data within a defined timeout interval. A read always is outstanding on the line to prevent loss of data from the line.

- READ, WRITE, WRITEREAD, and CONTROL operations let an application process explicitly control an asynchronous line. The application process handles the protocol of the line through reads and writes. This feature lets an application process handle a network involving diverse asynchronous terminals.

- An application process may perform Poll and Select operations through the WRITEREAD procedure. The application process handles the expected response.

- Data in variable length blocks is returned by way of file management procedures. The blocks may not exceed a quarter of the configured dedicated buffer. ENVOY performs no formal blocking other than the optional character termination of a read.

- The application checks character generation, and verifies and retries operations in error.

- Timeouts. ENVOY times all line operations.

- Transmit Pause feature causes the transmitted data line (BA-Pin 2) to pause whenever the secondary received data line (SBB-Pin 12) is high.

SECTION 2
PHYSICAL DESCRIPTION

The 6303/6304 ASYNC Controller and Extension boards consist of simplex-type Front End (FE) Board (Part Number 52990) and simplex-type Units Board (Part Number 53000), Terminal Connector Panel Assembly (Patch Panel) (Part Number 50253), and Interconnection Cables. Both circuit boards, which are 16.375 by 18.010 inches, are located in the I/O section of the system cabinet. Figure A-1 in Appendix A shows the two types of circuit board, and Figure A-2 shows their location in the system cabinet. Figure 2-1 shows the peripheral side of the Patch Panel.

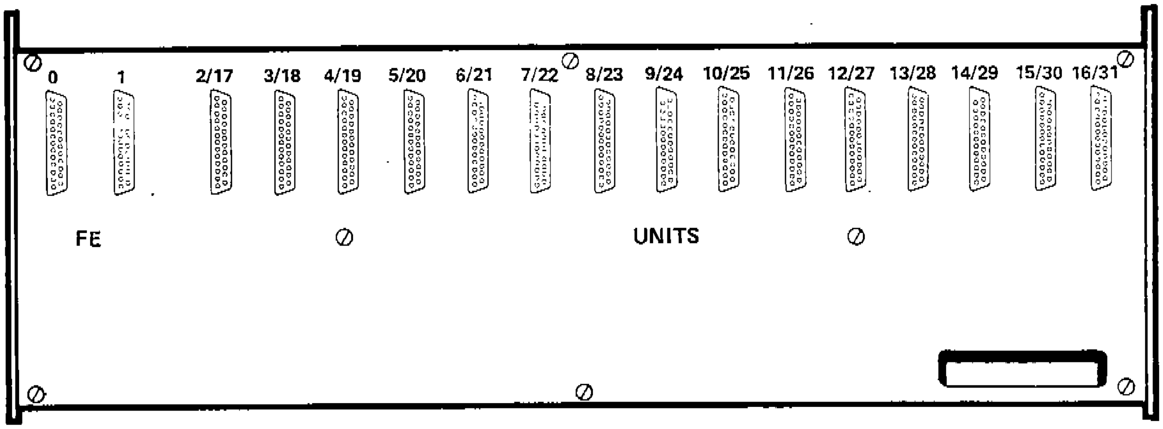


Figure 2-1 Patch Panel, Peripheral Side

The Front End (FE) is connected to two processors through standard I/O Bus port connections on P1. The FE supports two units ports on the Patch Panel .(Ports 0 and 1). Connection to these ports is by Cable Assembly 55135 between J4 on the FE board and J18 on the Patch Panel.

Each Units Board supports up to 15 I/O devices connected to the Patch Panel. Figure 2-2 shows the relative positions of these connectors on the Patch Panel. Each Patch Panel contains 17 EIA-compatible connectors (25-pin), and thus can handle up to 17 units (two units from the FE, and 15 units from the Units Board).

The FE Card connects with the Units Boards through P2 on the backplane. The interconnection between the FE and the Units Boards is fixed by the backplane connections and must be installed in specified I/O slots for correct operation (see paragraph 4.2.4).

2.1 SWITCHES, INDICATORS, AND JUMPERS

The FE board contains three DIP swiches, shown in Figure A-1, that set rank, address, and End of Text (ETX) character for the controller. The board also contains a pair of jumper posts for jumpering priority. Refer to Tables 4.1 and 4.2 for switch settings and functions.

There are no switches or jumpers on the Units Boards except the threshold setting jumpers. These jumpers and their disposition are discussed in Sections 4 and 5.

2.2 POWER REQUIREMENTS

The power requirements for the FE and Units Cards are as follows:

- 6303 Front End = 6.8 amps at 5 volts
- 6304 Units Board = 8.2 amps at 5 volts

2.3 OPERATING ENVIRONMENT

The ASYNC Controller operating environment is as follows:

- Temperature = 60 to 90 degrees F (15 to 32 degrees C)
- Relative Humidity = 30 to 80 percent (noncondensing)

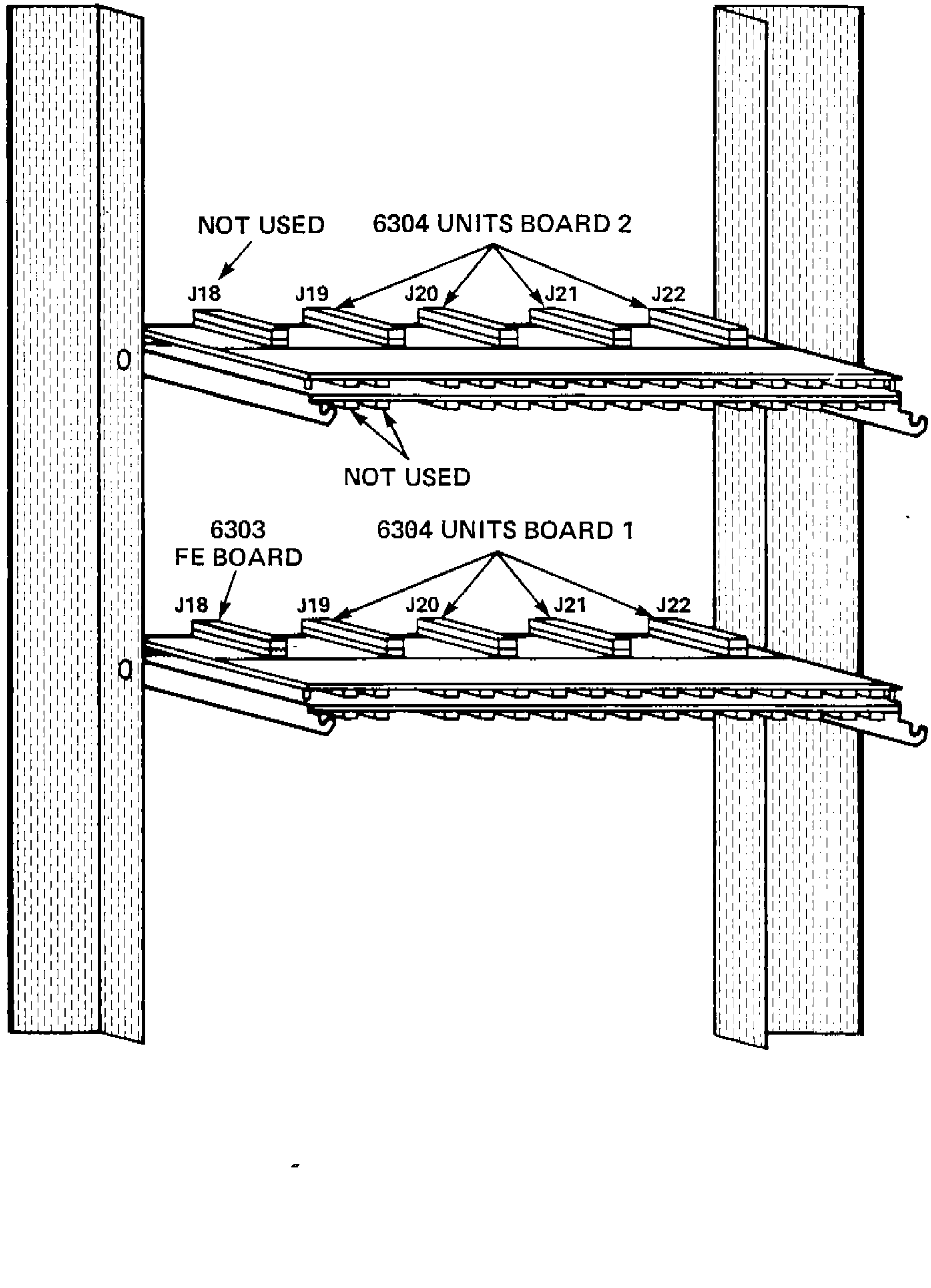


Figure 2-2 Patch Panel, Controller Board Side

SECTION 3
FUNCTIONAL DESCRIPTION

The ASYNC controller supervises the movement of data between the peripheral devices it controls and the I/O Channel. To carry out these operations, the controller must take into account or meet all of the following requirements:

- It must reformat data, converting it from parallel to serial for transmission to the peripheral devices and from serial to parallel for transmission to the channel.

  Since the peripheral devices handle data a single byte at a time, the controller divides the two-byte (16-bit) data word from the channel into two single bytes for use by the peripheral devices and reverses the procedure for transmission from the peripherals to the channel.

- It must read the status of all peripheral devices, generate an interrupt as required, and report that status to the channel.

3.1 MAJOR FUNCTIONAL UNITS

Figure 3-1 illustrates the functional relationship between the ASYNC controller and other units of the system. The ASYNC controller is a combination of the Front End board (FE) and one or two Units Boards. Control of peripheral devices by the ASYNC controller is through the Patch Panel, which has 17 units ports that connect to terminals, printers, or modems. The FE board controls units ports 0 and 1. The Units board controls ports 2 through 16. Up to 32 devices may be controlled by combining one FE board, two Units Boards, and two Patch Panels. For example:

- The FE board controls ports 0 and 1 on the first patch panel.
- One Units board controls ports 2 through 16 on the first patch panel.
- The second Units board controls ports 17 through 31 on the second patch panel.
- Ports 0 and 1 on the second patch panel are not used.

The major functional units of the FE Board are as follows:

- The UART
- The Microprocessor
- The RAM Stack

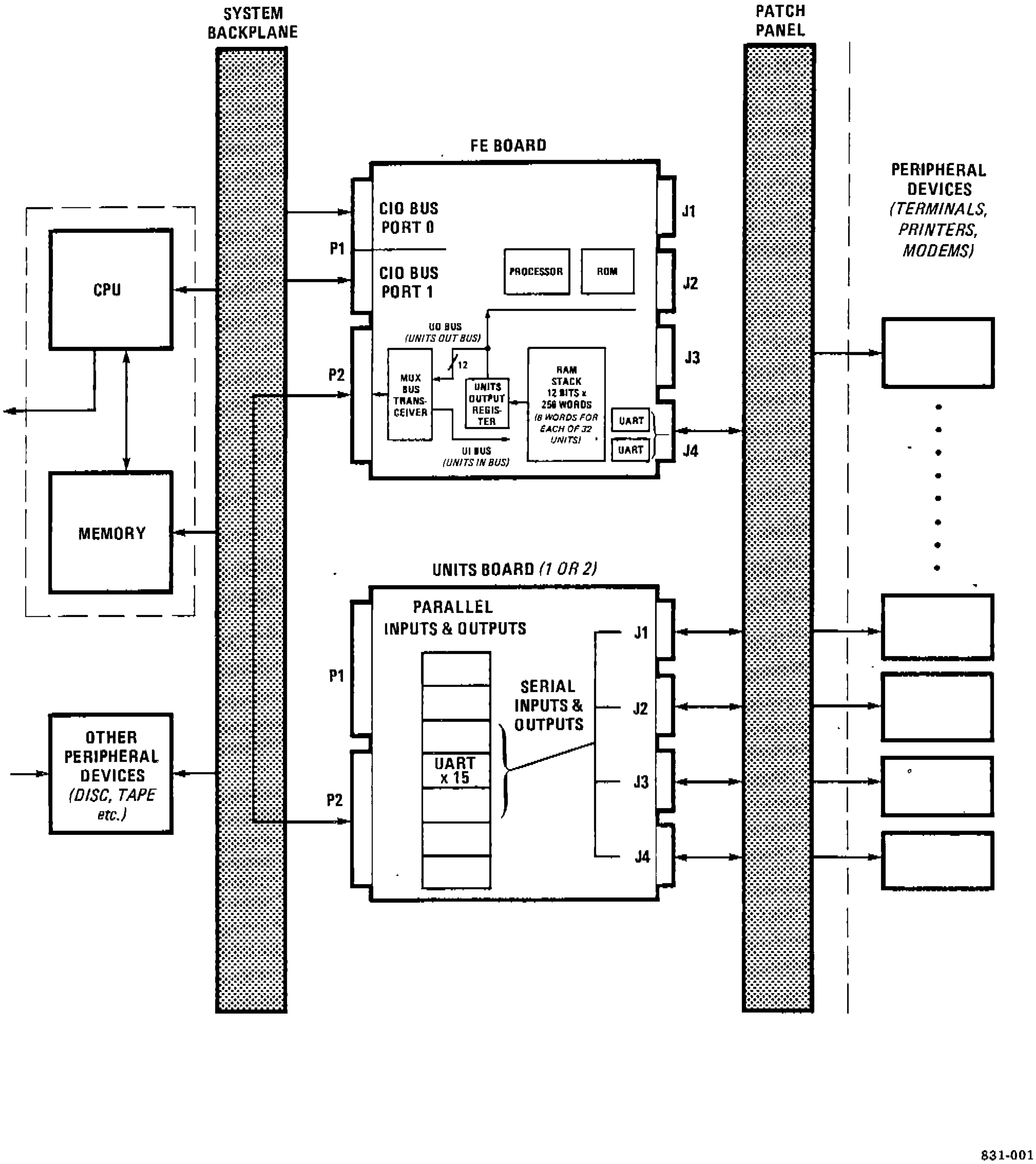


Figure 3-1 Functional Block Diagram

3.1.1 The UART

The interface between each peripheral device and the rest of the system is through a Universal Asynchronous Receiver/Transmitter (UART). The UART is used for data conversion for both transmission (parallel/serial) and receiving (serial/parallel). The UART provides data and status flags to the controller, which direct data flow or indicate error conditions. SYSGEN entries program the controller's word length select, number of stop bits, parity enabled or disabled, parity odd or even.

Figure 3-2 illustrates a one-to-one relationship between each peripheral device and its UART. For example: If the controller is assigned the address of %4, the FE board UARTs are assigned addresses %40 and %41 for the first two ports on the first patch panel. The Units board's 15 UARTS are assigned addresses %42 through %60 for ports 2 through 16 on the first patch panel. Addresses %61 through %77 are assigned to the second Units board's 15 UARTS for ports 17 through 31 on the second patch panel.

3.1.2 The Microprocessor

The microprocessor controls the scanning and checking of the unit's status, handles data transfers, and updates the RAM Stack with status information from the controller's array of UARTS.

The microprocessor interrogates (scans) each UART in succession from the lowest address or unit number to the highest. It repeats this sequence continuously. As each UART is scanned, the processor executes a set of instructions that check and act on the information provided both for and by that UART's peripheral unit. It ascertains whether there is a byte of data to be transferred to the channel, a reconnect operation has to be performed, or status updated. If necessary, it updates the UTS (Unit Termination Status) word in the RAM Stack for the particular unit, which the channel reads in order to service the interrupt.

3.1.3 The RAM Stack

The RAM stack consists of 256 twelve-bit registers. Each of the 32 possible peripheral units is allocated eight registers in the stack. The eight registers associated with each unit are used to store that unit's status and functional condition.

The RAM stack is common to the controller's microprocessor and to the channel. It can be written into or sensed by both, and console error messages are generated and decoded based upon the contents of the RAM registers. For example, when the ASYNC controller terminates an I/O operation for whatever reason, normal or abnormal, the controller sets certain bits in the UTS (Unit Termination Status) Register and generates an interrupt to inform the system. These bits are then decoded by the system for the RIC (Read Interrupt Cause) operation and the register cleared. The decoded UTS word forms the basis for a console error message. See Appendix C for additional information concerning console error messages.

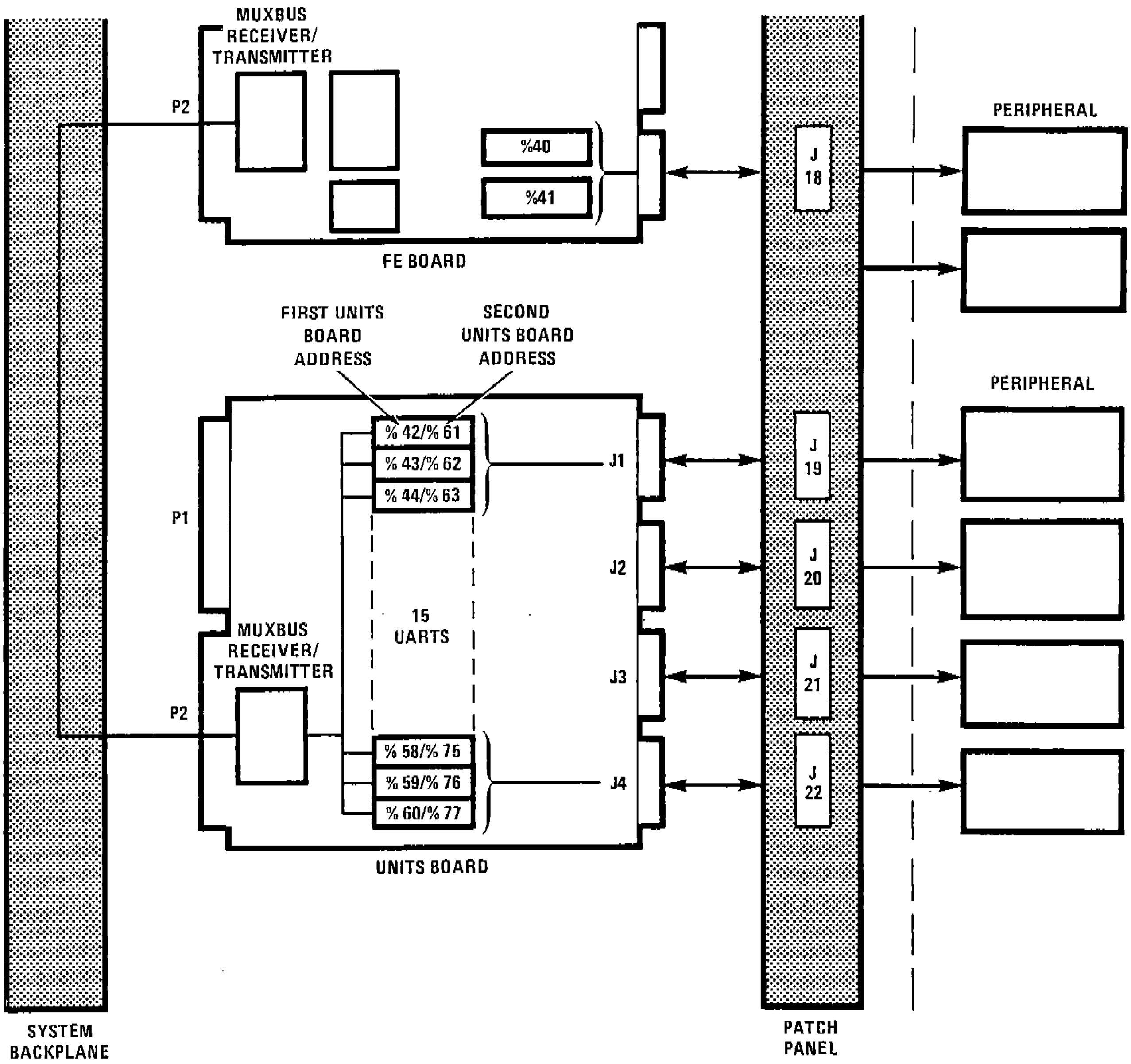


Figure 3-2 Functional Block Diagram, UART

3.2 UNIT ADDRESSING

Each line attached to the controller is identified by a unique unit address, and that unit appears as part of the EIO Address/Command word. The bit assignments are as follows:

- Bits 8 through 10 = Controller Number (%0 - %7)
- Bits 11 through 15 = Unit (Line) Number (%0 - %37)

However, the channel does not address the unit directly. Rather, it addresses the RAM stack on the FE Board corresponding to that unit, and loads the RAM registers with all the necessary data to execute the particular command.

SECTION 4
INSTALLATION

The procedures described in this section for the installation of 6303/6304 ASYNC Controller Boards are for use when installation is to be made in a new NonStop 1+ or NonStop system or when the controller is to be added to an already installed and operating system.

4.1 INSTALLATION IN A NEW SYSTEM

Under ordinary circumstances all controller boards are already in place in the I/O card cage upon arrival from the factory. When the system comes off the SIT floor configuration diagrams have already been drawn, all switches, jumpers, and priority settings have been made, and the STRESS program run. However, you should always verify that address switches and priority jumpers are correct. The only remaining task is to install and route the cables between the controller boards and the patch panels. For this procedure, see paragraph 4.2.3

4.2 INSTALLATION OF AN ADD-ON CONTROLLER

The 6303/6304 ASYNC Controller consists of one FE Board and one or two Extension or Units Boards. Refer to Section 2 for physical descriptions of these boards.

4.2.1 Unpack and Inspect the New Board(s)

Upon receiving a controller board, perform inspection as follows:

1. Open container and remove board from antistatic plastic bag. Save packing material for reshipping the board if it proves defective.

2. Check for cleanliness and ensure that there is no damage to the board, particularly at the edge contacts.

3. If a board has a defect or is damaged, it must be repacked and returned to a Tandem depot facility.

4. Each board should be protected in a separate plastic antistatic bag and reshipped using the same packing material in which the replacement board arrived.

5. To prevent damage from handling, there should be at least a two inch space between the board edges and the sides of the container. But, to avoid causing irreparable damage to the boards, do not stack more than one board in the same box.

6. The box must be closed securely with tape. If the shipping company will permit it, boxes may be taped together. For information concerning shipping companies and their particular requirements, refer to the Shipping Guide bulletin, available on request from TANDEM Shipping Department, Cupertino.

7. Remove or cover all old addressing information. Removal should include any old airport codes and destination stamps.

4.2.2 Switch Settings and Jumper Installation

Switches and jumpers are located on the controller board(s) as shown in Figure A-1 and shown diagrammatically in Figure 4-1.

4.2.2.1 Rank, Address, Priority, and ETX Settings

The FE board contains three dip switches. Two of these set rank and controller address. The third (U-17M) is used to jumper a configuration-dependent "ETX" (normally an ASCII %3). Tables 4.1 and 4.2 show the bit significance of these switches. There is also a pair of jumper posts for jumpering priority.

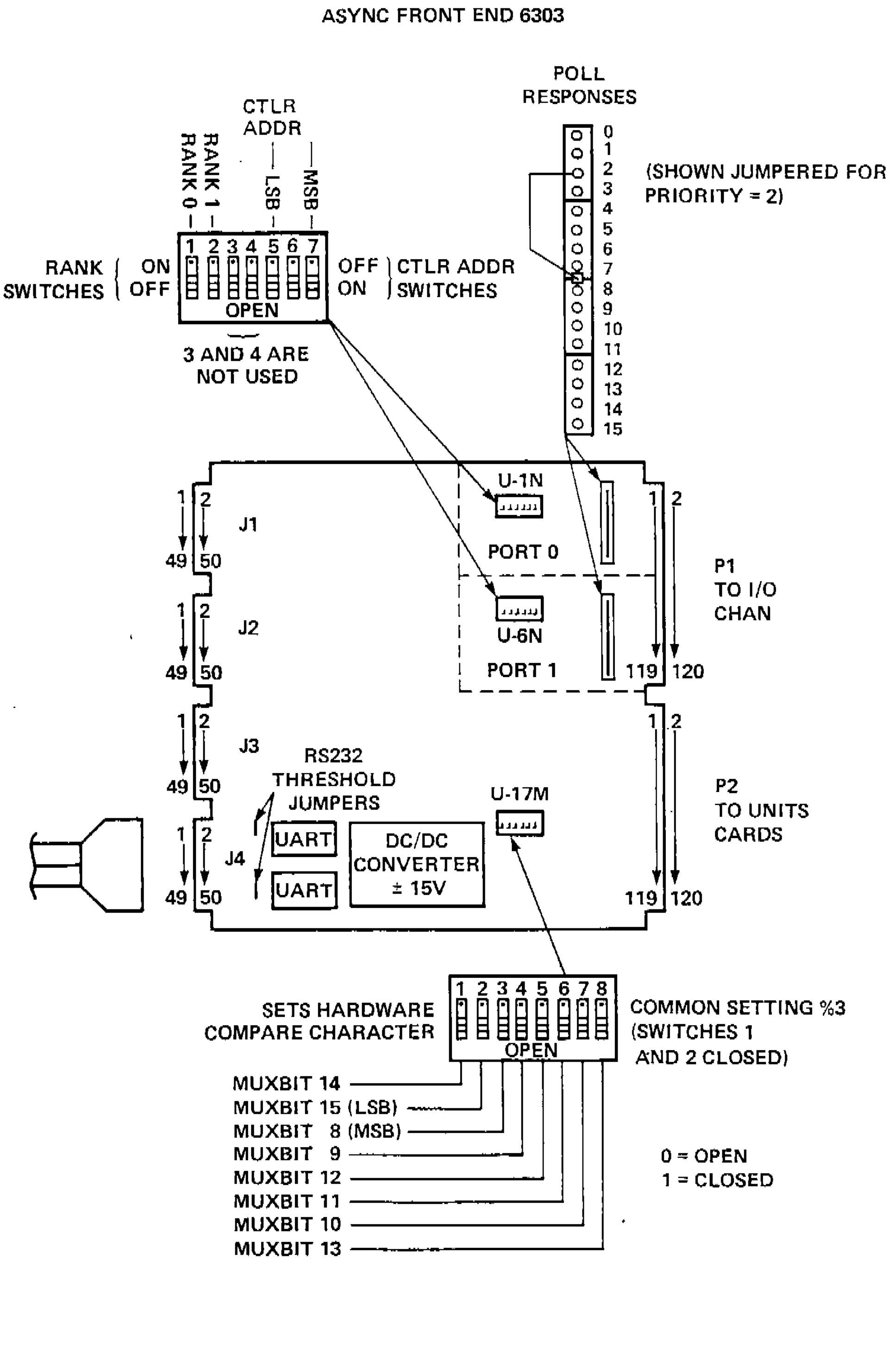


Figure 4-1 Rank, Address, Priority Switches, and Jumpers

Table 4.1 Switch Settings (U-1N and U-6N)

SWITCH POSITION	STATE CLOSED	OPEN	FUNCTION
1 (rank)*	ON	OFF	Selects rank 0
2 (rank)*	ON	OFF	Selects rank 1
3 (address)	O	1	Not used with FE Board
4 (address)	O	1	Not used with FE Board
5 (address)	O	1	Corresponds to data bus bit 10
6 (address)	O	1	Corresponds to data bus bit 9
7 (address)	O	1	Corresponds to data bus bit 8

* These switches are mutually exclusive.

Table 4.2 Switch Settings (U-17M)

SWITCH POSITION	STATE CLOSED	OPEN	FUNCTION
1	1	O	Selects logic 1 for muxbus bit <14>
2	1	O	Selects logic 1 for muxbus bit <15>(LSB)
3	1	O	Selects logic 1 for muxbus bit <8>(MSB)
4	1	O	Selects logic 1 for muxbus bit <9>
5	1	O	Selects logic 1 for muxbus bit <12>
6	1	O	Selects logic 1 for muxbus bit <11>
7	1	O	Selects logic 1 for muxbus bit <10>
8	1	O	Selects logic 1 for muxbus bit <13>

4.2.2.2 Modem Control Threshold Settings

When an ASYNC communications line using an RS-232 interface is operated with a modem (or any other device that requires modem control signals), it may be desirable to change the signal threshold on the incoming modem control signals (Data Set Ready, Carrier Detect, Clear to Send, and Secondary Reverse Channel). In carrying out the following procedures, note that in standard RS-232 protocol, a "mark" is any value between -25 volts and -3 volts. A "space" is any value between +3 and +25 volts. Values between -3 and +3 volts are undefined.

The standard Tandem EIA receiver (Part Number 75154) is set to either of two threshold levels as follows:

- Threshold high (tied to +5 volts), with this setting:

    1. A "mark" is any value between -25 and -1.1 volts.
    2. A "space" is any value between +2.1 and +25 volts.
    3. The region between -1.1 and 2.1 volts is latched as space or mark depending on previous signal level.
    4. If signal is disconnected, the line level is between 0 and 1 volt, approximately.

- Threshold open, with this setting:

    1. A "mark" is any value between -25 and +1.4 volts.
    2. A "space" is any value between +2.1 and +25 volts.
    3. The region between +1.1 and 2.1 volts is latched as space or mark depending on previous signal level.
    4. If signal is disconnected, the line level is between 0 and 1 volt, approximately, (a constant "mark" signal).

The normal setting for receivers is +5 volts (threshold high). However, some customers may want to detect the line state if a cable becomes inadvertently disconnected. If this is the case, the threshold setting for the receivers must be accomplished by cutting jumpers as follows:

- FE Board Threshold Setting

  1. Refer to the inset in Figure 4-2.

  2. Locate the PC jumper for unit 0 of the FE board (just to the left of U-18A); the jumper is located between the two feedthroughs that have an etch running to pin 1 of U-18A. Cut for threshold open.

  3. Locate the PC jumper for unit 1 of the FE board (just to the left of U-19A); the jumper is located between the two feedthroughs that have an etch running to pin 1 of U-19A. Cut for threshold open.

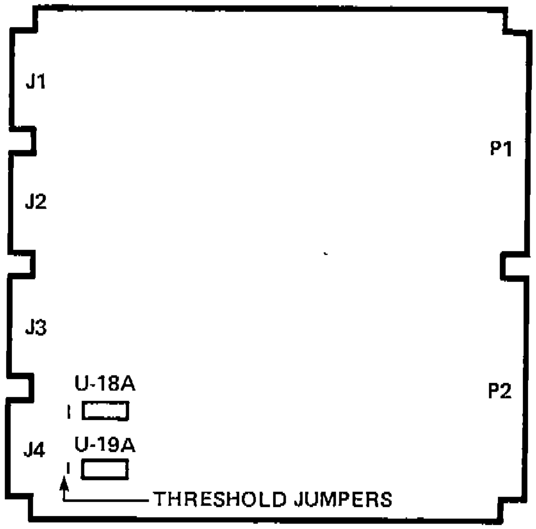


Figure 4-2 FE Threshold Jumper Locations

- Units Board Threshold Setting

  1. Refer to the inset in Figure 4-3.

  2. Locate the PC jumper for units 0 through 7 on the Units board (just beside and parallel to U-1B-14, 15, and 16); cut the jumper.

  3. Locate the PC jumper for units 8 through 15 on a Units board (just beside and parallel to U-9B-14, 15, and 16); cut the jumper.

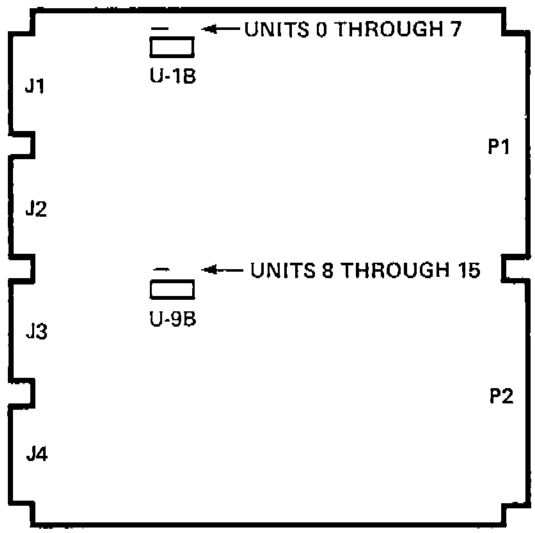


Figure 4-3 Units Threshold Jumper Locations

4.2.3 Install ASYNC Patch Panel 7501 and Patch Panel Cabling

The ASYNC Patch Panel is shown in Figures 4-4 through 4-5. Refer to these figures and follow this procedure.

1. Install ASYNC Patch Panel 7501 (Tandem Part Number 50253) on the rear of the tape drive cabinet.

2. Connect FE Board cable to J18 on the inside of the Patch Panel as shown in Figure 4-4

3. Connect Units Board cables to J19, J20, J21, and J22 on the inside of the Patch Panel as shown in Figure 4-5.

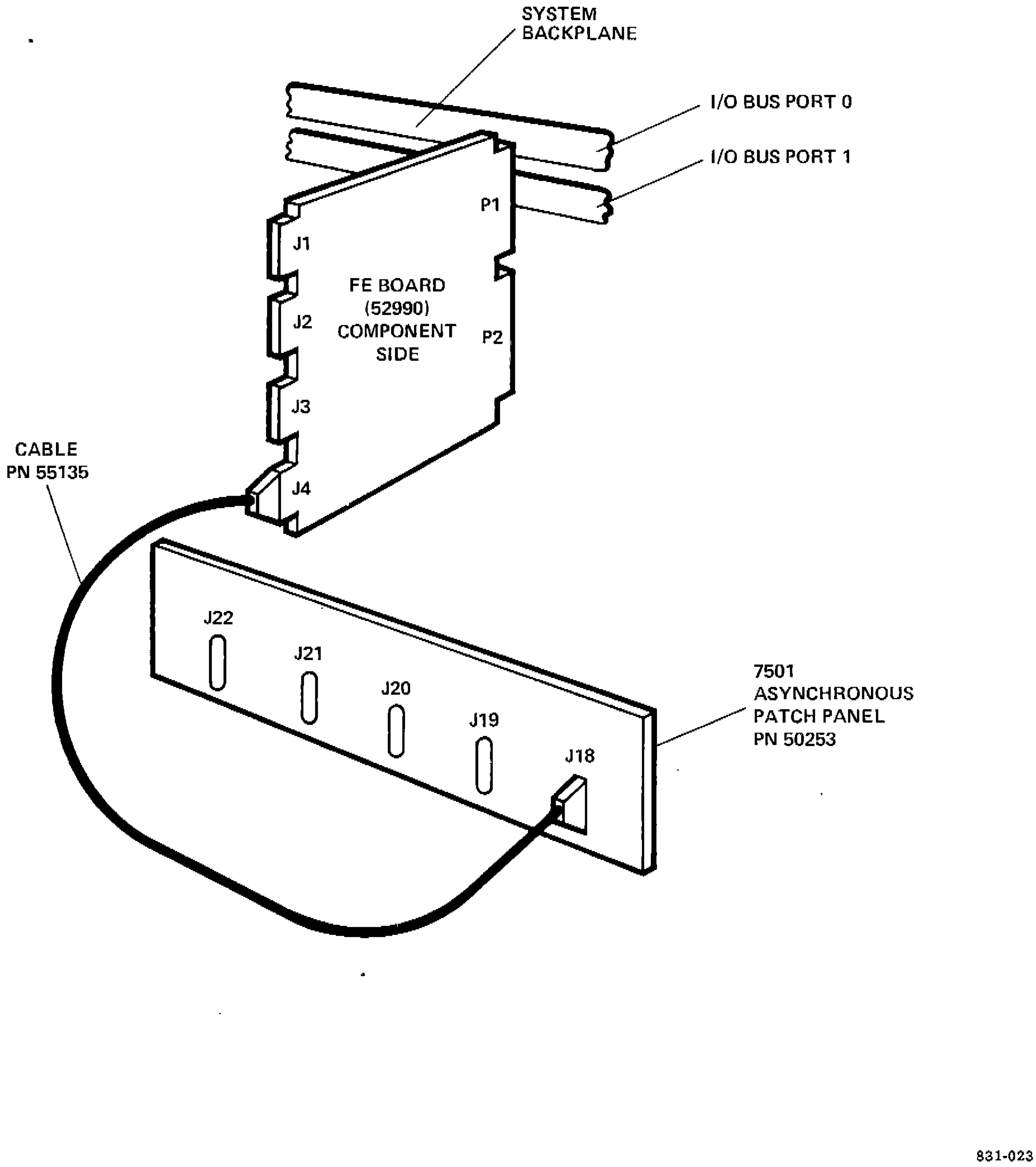


Figure 4-4 Controller Interconnection Diagram for FE Board

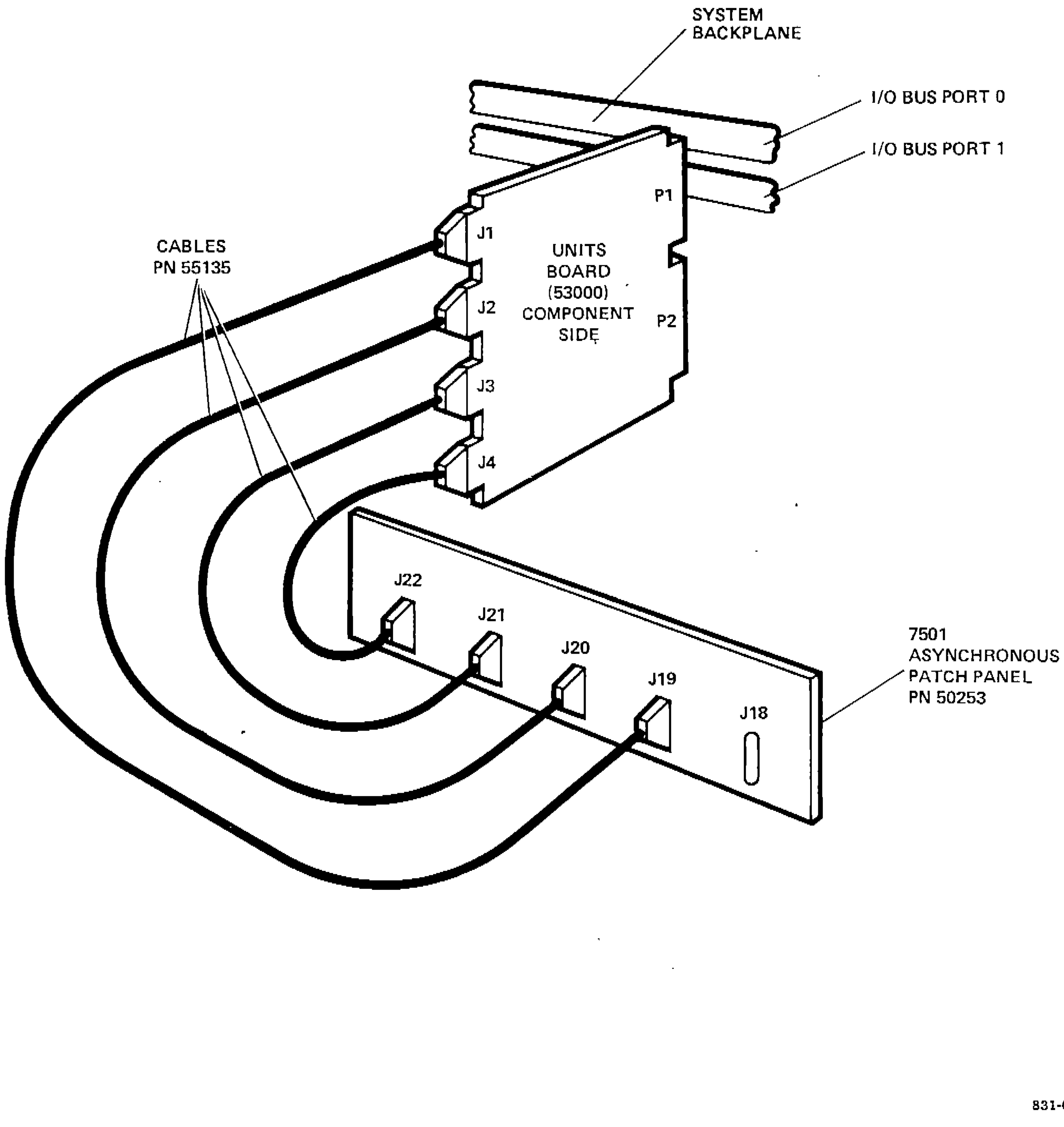


Figure 4-5 Controller Interconnection Diagram for Units Board

4.2.4 Install the Controller Board(s).

Because of backplane configuration, ASYNC Controller Boards must be installed in specific slots as indicated in Figures 4-6 and 4-7.

If the FE is placed in slots 2, 10, 18, or 26 in the new style backplane (52000 and 53510 Mod II), there is only one slot available for the Units card.

When using the old style backplane (51150), slots 1, 5, 9, 13, 17, 21, 25, or 29 cannot be used by the FE or Units cards without custom modification.

1. Turn off the I/O voltage regulator to the assigned slots in the system cabinet,

2. Install the controller boards in the assigned slots by carefully sliding the board in from the front of the cabinet. Make sure that the boards rear edge connectors P1 and P2 are lined up properly and then push the board from the front until it is seated into the backplane connector. Slowly tighten the hold-down screw on the rear of the system cabinet.

   CAUTION

   You should not install the controller boards in I/O slots using only the hold-down screw in the rear of the system cabinet. Tightening this screw before the board is properly seated can damage the screw, break traces on the boards, or cause board seating problems. The hold-down screw should only be finger-tight.

3. On the FE board, connect the Patch Panel cable labeled J4 to the board edge connector J4 (bottom connector). See Figure 4-4

4. On the Units Boards, connect the Patch Panel cables labeled J1, J2, J3, and J4 (as required) to the corresponding board edge connectors. See Figure 4-5.

4.2.5 Verification

There are no verification test procedures for ASYNC controller boards. However, the following steps should be carried out.

1. After inserting boards into their correct slots and completing all of the interconnections, power on the system and execute the system startup file to bring the ASYNC controller on line. If the startup file does not have a command to start a Command Interpreter, you must start one up on each down terminal.

2. Run ACOM6303 and any SHADOW or other applicable diagnostics if possible.

3. Verify SYSGEN. This step is the responsibility of the system manager.

CONTROLLER	SLOT											
	1 OR 13	2 OR 14	3 OR 15	4 OR 16	5 OR 17	6 OR 18	7 OR 19	8 OR 20	9 OR 21	10 OR 22	11 OR 23	12 OR 24
ASYNCHRONOUS CONTROLLER WITH 2 UNITS CARDS	***	**	*	***	**	*	***	**	*	***	**	*
ASYNCHRONOUS CONTROLLER WITH 1 UNITS CARD		**	*		**	*		**	*		**	*

* FE (0-1)
** UNITS (2-16)
*** UNITS (17-31)

831-008

Figure 4-6 NonStop Systems I/O Slot Restrictions

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
UNITS 1	FRONT END	UNITS 2	UNITS 1	FRONT END	UNITS 2	UNITS 1	FRONT END

831-009

Figure 4-7 NonStop 1+ Systems I/O Slot Restrictions

SECTION 5
CORRECTIVE MAINTENANCE

Corrective maintenance is accomplished as follows:

- If the fault is due to a defective FRU (field replaceable unit), by isolating the faulty FRU and replacing it with a good one.

- If the fault is due to a human error (a downed communication line, a switch incorrectly set, or similar circumstance) that can be solved by some procedure from the console, by carrying out that procedure.

The complement of FRUs for the ASYNC subsystem consists of the controller boards, patch panels, and the connecting cables from the controller boards to the patch panels. The ASYNC devices themselves are not FRUs, and you are not normally called upon to replace them; however, they are integral parts of the complete ASYNC subsystem, and it is your responsibility to show that a device is defective when that is the case.

For the discussions in this section, refer to Figure A-3, Field Replaceable Units, ASYNC Subsystem, in Appendix A.

Before attempting any corrective measures on the system, analyze the symptoms as thoroughly as possible:

- Get a description of system behavior just prior to the failure.

- Determine, if possible, whether this is a recurrent problem. The equipment history log and any failure (incident) reports available for the system can prove useful in answering this question.

- Find out whether any changes have been made in the system or its configuration that might have caused the problem, such as operating system updates or new devices changed or added that have not been SYSGENed. If so, determine when the present failure occurred because of these changes.

- Find out what console error messages, if any, were displayed when the failure occurred.

  Each console message is identified by a message number. For the ASYNC controller, the most significant console messages are numbers 04, 05, 37, and 62. Console message numbers should not be confused with those of any other system, such as File Management Error message numbers.

  A summary of the main features of console and OPRLOG messages together with some typical examples are given in Appendix C. If you are not thoroughly familiar with the significance of the various fields and bits of these messages, you should read Appendix C at this time.

It is assumed that you have already determined that the problem is limited to the ASYNC system and that symptoms only appear in those devices associated with the ASYNC controller. The next step in isolating the problem to a single FRU is to observe how many devices are involved: one, some set (more than one but fewer than all), or all.

5.1 A SINGLE DEVICE IS DOWN

The most common ASYNC failure occurs when a single device is down. However, it is also the case requiring the lengthiest troubleshooting procedures.

Direct substitution of a known good device for the one under test is the recommended troubleshooting procedure whenever possible. However, since it is often necessary to bring at least part of the system off line when making a substitution, some preliminary tests should always be performed to minimize both the amount of down time and the number of devices taken off line.

5.1.1 Terminals

The first step in all cases involving terminals is to observe the screen display and test for a Command Interpreter (CI) by pressing the RETURN key. If the hardware in the controller associated with receiving and transmitting a single character is functioning properly and the path between the channel and terminal under test is complete, the CI prompt (:) should appear in the first column on the screen and on successive lines each time the key is pressed.

A malfunctioning terminal will usually exhibit one of the following conditions. Begin your troubleshooting at the paragraph indicated in parentheses next to each condition.

- The screen has some presentation other than a Command Interpreter prompt (Paragraph 5.1.1.1).
- Keyboard Lock (The cursor is in a fixed location, often in column 1, line 1, and pressing the RETURN key has no effect.) (Paragraph 5.1.1.2).
- The screen is blank or has no indication of power (Paragraph 5.1.1.3).

5.1.1.1 Display Other Than a CI Prompt, Keyboard Not Locked

1. If the screen display is other than a CI, go to a properly functioning terminal, log on, and execute a STATUS* command for the terminal under test, as follows:

   ```
   :STATUS*, TERM $CRTXXX
   ```

   $CRTXXX is the name of the terminal under test. If the name of the terminal is not posted on the terminal itself, you will probably have to get it from the system manager.

The STATUS command returns all processes running on $CRTXXX in the following format:

```
PID     PRI  PFR  %WT  USERID      MYTERM       PROGRAM FILE NAME

nn,nnn mmm  P R  qqq  ddd,ddd     $CRTXXX    $SYSTEM. SYS00. COMINT
```

2. If the STATUS command shows that the system is sending a Command Interpreter to the terminal, check for a defective data cable between the patch panel and the terminal. Use the following procedure:

   a. If possible, substitute a known good cable for the one under test. You can make the substitution using either an auxiliary cable or the cable belonging to some other device that is functioning properly. Note, however, that although all cables to ASYNC devices use RS-232 connectors, they are not always interchangeable. Ensure that any substitute cable has the same pin configuration as the cable being tested.

   b. If substitution is not possible, a cable can be tested using a breakout box. Instructions for correct use of the breakout box are contained in the breakout box.

3. If the STATUS command shows that there is no CI being sent to the terminal under test, attempt to start a CI.

   A Command Interpreter can be started on a terminal in a variety of ways. The following command can be executed from the console or other functioning terminal:

   ```
   :COMINT /NOWAIT,IN $CRTXXX,OUT $CRTXXX,NAME $CYYY,CPU Z,PRI 150
   ```

   where $CRTXXX is the logical device name; $CYYY is the terminal name, and Z is the number of the default cpu for the terminal.

4. If the Startup command is apparently executed by the system, do another STATUS* command to double check and repeat the test for a CI (Paragraph 5.1.1). If the CI appears, verify that the problem has been solved by using the terminal under normal conditions.

5. If a CI cannot be started, go to Step 7, Paragraph 5.1.1.2.

5.1.1.2 Keyboard Locked

If you observe that the cursor is locked, and the RETURN key has no effect, it is often the result of the terminal having been taken off line (downed) by an operator or of it being in the "not ready" state. In either case, proceed as follows.

1. If the terminal has a RESET key or reset operation described in the user's manual for the terminal, press the RESET key or perform the operation.

2. If there is no change in the display, try turning the power switch off and back on and again.

3. If possible, execute any self-test routines prescribed for the terminal (consult the terminal's user guide).

4. If the reset or self-test operations execute normally, but the terminal returns to the locked condition at the end of the operation, the terminal is probably good.

5. If you are unable to reset the terminal, it is probably bad. Substitute a known good terminal of the same type and with the same configuration settings. Proceed as follows:

   a. Turn power switch OFF.

   b. Remove power and data cables from terminal under test.

   c. Connect these cables into the corresponding jacks on the good terminal.

   d. Turn power switch ON and again observe the display.

6. If the display returns to normal (a CI appears and functions normally), verify that the problem has been solved by using the good terminal under normal conditions.

7. Check the state of the device by using the PUP LISTDEV command:

   ```
   :PUP LISTDEV
   ```

   PUP LISTDEV returns all pertinent details of the configuration and operational states of all system devices. The state of the device is listed in column two of the LISTDEV readout. A blank in this column means that the device is UP. A "D" in this column means that the device has been downed. (For more details of this command see Appendix B.).

8. If the LISTDEV readout shows the terminal to be UP, and you have not yet tried to bring it UP with the PUP UP command, substitute a known good terminal for the one under test. Proceed as in Steps 4 and 5.

9. If the LISTDEV readout shows the terminal to have been downed (D), attempt to bring the device UP by the command:

   ```
   :PUP UP $<device-name>
   ```

10. Start a Command Interpreter for the terminal as described in Step 3 of Paragraph 5.1.1.1, and again check the state of the terminal as in using the PUP LISTDEV command.

11. If the PUP UP command brings the terminal up, verify that the problem has been solved by using the terminal under normal conditions.

12. If you cannot bring a terminal UP using the PUP UP command when it has been downed, the problem is likely to be in the controller board(s). Proceed to the next step.

NOTE

The same inability occurs if the power supply regulator is bad; however, if this is the case, more than a single terminal or device will be out, unless, of course, there is only a single terminal connected to the board.

13. Identify the controller board that contains the UART associated with the terminal under test.

    To make this identification you must first determine the terminal's unit number (PCU number), either by consulting the system configuration file or by using the PUP LISTDEV command.

    To identify the unit number from the LISTDEV readout, use the logical device name shown in the readout and then refer to the PCU number on the same line. In most installations, the logical device name of each terminal is posted somewhere on its cover.

14. Refer to Table 5.1 with the terminal's unit number determined in Step 13 and go to the line in the address column corresponding to that address or range of addresses. Assume a starting address of %40.

Table 5.1 ASYNC Controller Boards I/O Port Addressing

PCU NUMBERS OF UNIT PORT	ASYNC CONTROLLER BOARD
%40 and %41	FE BOARD
%42 - %60	UNITS BOARD #1
%61 - %77	UNITS BOARD #2

15. Replace the board containing the suspected UART. Repeat Step 7.

5.1.1.3 The Screen Is Blank or Has No Indication of Power

If the screen is blank, perform the following:

1. Check power switch and power cord. Verify that the switch is ON and the power cord is connected.

2. Wait a few seconds for the terminal to warm up.

3. If there is no evidence of raster or other video display after 30 seconds or so, and the terminal has an external brightness adjustment, try adjusting it to produce a video display.

4. If Step 3 produces a normal video display (a CI is present etc.), verify that the problem has been solved by using the terminal under normal conditions.

5. If Step 3 fails to produce a video display, check for blown power fuses or circuit breakers on the terminal.

6. If a blown fuse or open circuit breaker is found, first turn power switch OFF, then replace the fuse or reset the breaker.

7. Repeat Steps 1 through 6; however, if a second fuse blows, or the circuit breaker reopens, there is probably a short in the primary power circuit of the terminal. If possible, substitute a known good terminal of the same type for the terminal under test. When making substitutions of this kind, ensure that all configuration and function switches and jumpers on the good terminal are set to the same positions as those on the terminal under test.

8. If Step 7 produces a normal video display (a CI is present, etc.), verify that the problem has been solved by using the terminal under normal conditions.

9. If fuses/circuit breakers are good/closed, check all cables for loose connections or defective connectors.

10. If there is evidence of loose connections or defective connectors, tighten or replace as required to restore good connections.

11. If Step 10 produces a normal video display (a CI is present, etc.), verify that the problem has been solved by using the terminal under normal conditions.

12. If there is no evidence of bad connection, test for presence of AC power from the input lines in the power plug.

13. If there is power present at the plug, the terminal's power circuits are probably defective. Try substituting a known good terminal for the one under test. Repeat Steps 1 through 6.

14. If Step 13 produces a normal video display (a CI is present etc.), verify that the problem has been solved by using the terminal under normal conditions.

15. If there is no power present at the plug, locate power panel that supplies primary AC power to the terminal(s).

16. At the power panel, test for presence of AC power on the lines to the terminal(s).

17. If AC power is present on the lines to the terminal(s) under test, the power cable to the terminal(s) is defective. It should be replaced.

18. If AC power is not present at the power panel, check for open circuit breaker.

19. If an open circuit breaker is found, first turn power switch(es) at the terminal(s) OFF, then reset the breaker.

20. Turn power switch(es) ON and go back to Step 1.

21. If the circuit breaker reopens, there is a a short in the primary power circuit of the terminal(s) or the lines to the terminal(s). They should be replaced.

5.1.2 Printers

The same general troubleshooting principles apply to serial printers as well as terminals with the exception that there are fewer of them, and the symptoms of malfunctioning are not as easily seen.

5.1.2.1 Printer Has No Indication of Primary (AC) Power

If the printer has no indication of AC power, perform the following:

1. Test the power input lines for the presence of AC power.

2. Verify that the printer is connected to its power source and that the power switch is ON.

3. Check for defective fuses or open circuit breakers.

4. Check all cables for loose or faulty connections.

5. If there is still no indication of power, the problem is most likely in the printer itself.

5.1.2.2 Printer Cannot Communicate With the System

After each of the following tests check the results by trying to print a short file. If successful, verify that problem has been solved by using the printer under normal conditions.

1. Carry out any self-test routines that the printer may have (see user's manual for the printer).

2. If the printer has a reset function, reset it and observe the motion or action of the print head, if applicable.

3. If the printer is one that has an external SELECT switch, verify that when required, it is on.

4. Determine also whether configuration, data rate, or protocol switches or settings are correct by referring to the appropriate manual.

5. Log onto the system from the console as SUPER.GROUP (if necessary to use the PUP program) and determine the operational status of the printer by using the command:

```
:PUP LISTDEV
```

PUP LISTDEV returns all pertinent details of the configuration and operational states of all system devices. The state of the device is listed in column two of the LISTDEV readout. A blank in this column means that the device is UP. A "D" in this column means that the device has been downed by the operator. (For more details of this command see Appendix B.).

6. If the LISTDEV readout shows the printer to be UP, and you have not yet tried to bring it UP with the PUP UP command, the problem is likely to be in the printer itself or in the interconnecting data cable.

7. Check for a defective data cable between the patch panel and the printer using the following procedure:

   a. If possible substitute a known good cable for the one under test. You can make the substitution using either an auxiliary cable or the cable belonging to some other device that is functioning properly. Note, however, that although all cables to ASYNC devices use RS-232 connectors, they are not always interchangeable. Ensure that any substitute cable has the same pin configuration as the cable being tested.

   b. If substitution is not possible, a cable can be tested using a breakout box. Instructions for correct use of the breakout box are contained in the breakout box.

8. If the LISTDEV readout shows the printer to have been downed (D), attempt to bring it UP by executing the command:

```
:PUP UP $<device-name>
```

9. Again check the state of the printer using PUP LISTDEV.

10. If the PUP UP command brings the printer up, verify that the problem has been solved by using it under normal conditions.

11. If you cannot bring the printer UP using the PUP UP command when it has been downed, the problem is likely to be in the controller board(s). Proceed to the next step.

    The same inability occurs if the power supply regulator is bad; however, if this is the case, more than a single device will be out, unless, of course, there is only a single device connected to the board.

12. Identify which of the controller boards has control of the printer under test.

    To make this identification you must first determine the printer's unit number (PCU number) either by consulting the system configuration file or by using the PUP LISTDEV command as in Step 5.

    To identify the unit number of the printer under test from the LISTDEV readout, use the logical device name shown in the readout and then refer to the PCU number on the same line. In most installations, the logical device name of each device is posted somewhere on its cover.

Figure 5-1 shows the location of specific UARTs on the controller boards. Table 5.1 shows the range of PCU numbers associated with the UARTs on each of the controller boards.

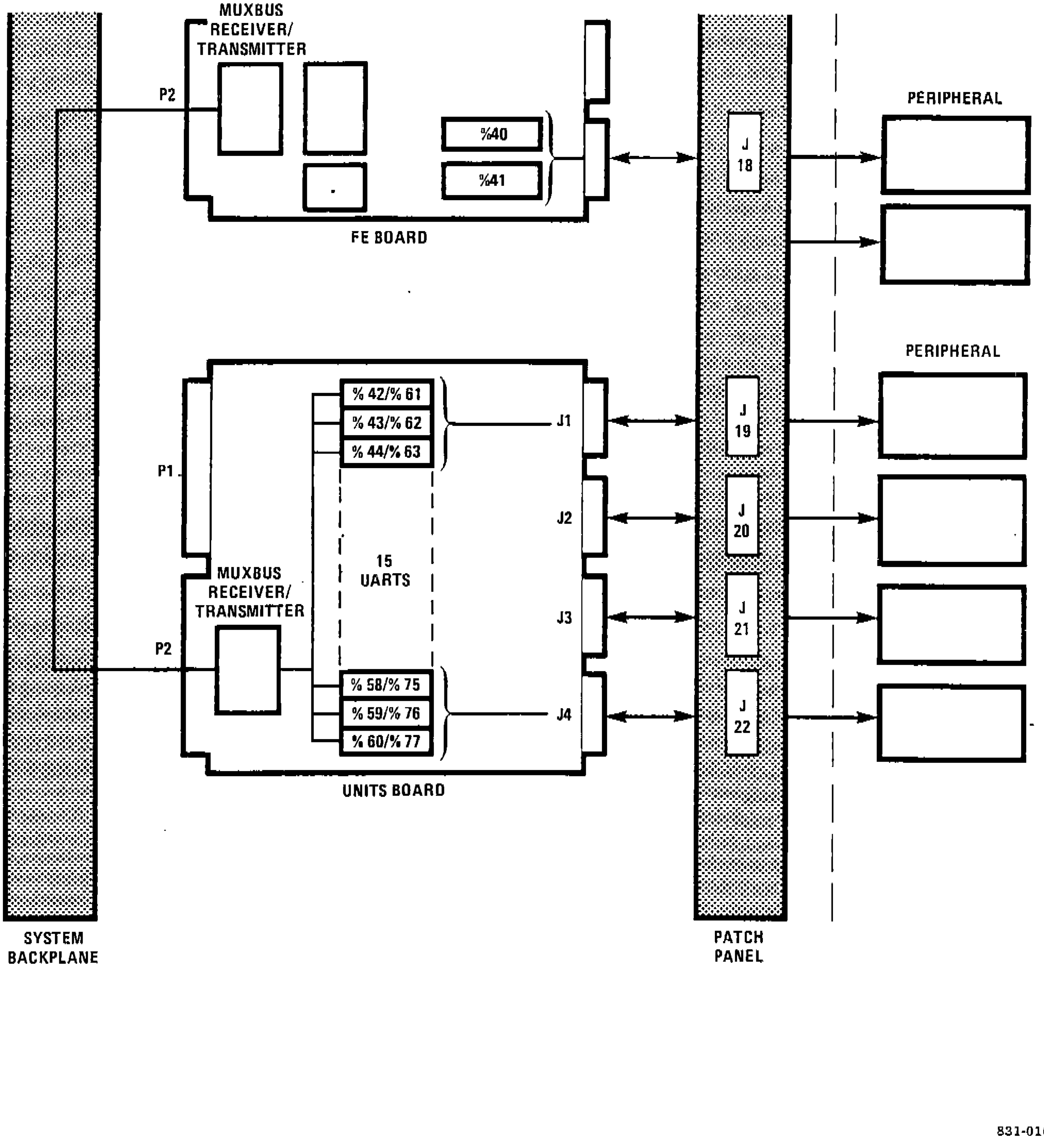


Figure 5-1 Peripheral Addressing Scheme

5.1.3 Modems

The same general troubleshooting principles apply to modems as well as terminals and printers.

5.1.3.1 Modem Has No Indication of Primary (AC) Power

If the modem has no indication of AC power, perform the following:

1. Test the power input lines for the presence of AC power.
2. Verify that the modem is connected to its power source and that the power switch is ON.
3. Check for defective fuses or open circuit breakers.
4. Check all cables for loose or faulty connections.
5. If there is still no indication of power, the problem is likely in the modem itself.

5.1.3.2 Modem Cannot Communicate With the System

After each of the following tests check the results by trying to transmit a short file to some accessible destination. If successful, verify that problem has been solved by using the modem under normal conditions.

1. Carry out any self-test routines that the modem may have (see user's manual for the modem).
2. If the modem has a reset function, reset it.
3. Determine also whether configuration, data rate, or protocol switches or settings are correct by referring to the appropriate manual.
4. Log onto the system from the console as SUPER.GROUP (if necessary to use the PUP program) and determine the operational status of the modem by using the command:

   ```
   :PUP LISTDEV
   ```

   PUP LISTDEV returns all pertinent details of the configuration and operational states of all system devices. The state of the device is listed in column two of the LISTDEV readout. A blank in this column means that the device is UP. A D in this column means that the device has been downed by the operator. (For more details of this command see Appendix B.).
5. If the LISTDEV readout shows the modem to be UP, and you have not yet tried to bring it UP with the PUP UP command, the problem is likely to be within the modem itself or in the interconnecting data cable.

6. Check for a defective data cable between the patch panel and the modem using the following procedure:

   a. If possible substitute a known good cable for the one under test. You can make the substitution using either an auxiliary cable or the cable belonging to some other device that is functioning properly. Note, however, that although all cables to ASYNC devices use RS-232 connectors, they are not always interchangeable. Ensure that any substitute cable has the same pin configuration as the cable being tested.

   b. If substitution is not possible, a cable can be tested using a breakout box. Instructions for correct use of the breakout box are contained in the breakout box.

7. If the LISTDEV readout shows the modem to have been downed by the operator (D), attempt to bring it UP by executing the command:

```
:PUP UP $<device-name>
```

8. Start a Command Interpreter for the modem as described in Step 3 of Paragraph 5.1.1.1, and again check the state of the modem as in Step 4.

9. If the PUP UP command brings the modem up, verify that the problem has been solved by using it under normal conditions.

10. If you cannot bring the modem UP using the PUP UP command when it has been downed by the operator, the problem is likely to be in the controller board(s).

NOTE

The same inability occurs if the power supply regulator is bad; however, if this is the case, more than a single device will be out, unless, of course, there is only a single device connected to the board.

11. Identify which of the controller boards has control of the modem under test.

    To make this identification you must first determine the modem's unit number (PCU number) either by consulting the system configuration file or by using the PUP LISTDEV command as in Step 4.

    To identify the unit number of the modem under test from the LISTDEV readout, use the logical device name shown in the readout and then refer to the PCU number on the same line. In most installations, the logical name of each device is posted somewhere on its cover.

    Figure 5-1 shows the location of specific UARTs on the controller boards. Table 5.1 shows the range of PCU numbers associated with the UARTs on each of the controller boards.

5.2 SOME SET OF DEVICES IS DOWN

With more than a single device down, the problem will normally be found in the controller boards or in power circuits associated with the boards rather than in the devices themselves or in the cabling. Since the defective FRU is most likely to be one of the controller boards, the different types of device (terminals, printers, modems) are not treated separately in this section.

5.2.1 Down Devices Do Not Have Primary (AC) Power

If the down devices do not have input power, the problem is almost certainly in the distribution panel or farther back. Use the power panel checks beginning at Step 16, Paragraph 5.1.1.3.

5.2.2 Down Devices Cannot Communicate With the System

To troubleshoot this problem, perform the following:

1. List the unit numbers of the down devices.

   Note especially if the unit numbers are in sequence. It is often the case that one of the DC-to-DC converters on a Units Board has failed. These converters supply DC power to blocks of contiguous UARTs on the boards.

2. Using the procedure beginning at Step 13, Paragraph 5.1.1.2, determine which controller boards contain the UARTs associated with the down devices. One of the following conditions will exist:

   a. If the unit numbers of the down devices are in sequence and in blocks of seven or eight, substitute a known good board or boards for the ones indicated. Use the procedures described in Paragraph 5.4 for making the substitution.

   b. If the unit numbers of the down devices have random values and are associated with a single controller board, substitute a known good board for the one indicated. Use the procedures described in Paragraph 5.4 for making the substitution.

   c. If the unit numbers of the down devices are random but are associated with more than a single board, the problem is likely to be either in the software or the FE board. Substitute a known good FE board for the one installed. Use the procedures described in Paragraph 5.4 for making the substitution.

3. Check the down devices to determine if they are now functioning correctly. If they are, verify that the problem has been solved by operating the devices under normal conditions.

5.3 ALL DEVICES ARE DOWN

If all devices are down, the fault probably lies in the FE board, in the primary power to the devices, or in the software. Troubleshoot as follows:

1. Check for the presence of primary AC power to the devices.

2. If there is no evidence of ac power to the devices, use the power panel checks beginning at Step 16, Paragraph 5.1.1.3

3. Verify that the power supply regulator for the FE board is good by substituting a known good regulator board for the one installed.

4. If the devices have primary power and the regulator is good, but still cannot communicate with the rest of the system, the problem is likely to be in the FE board itself. Substitute a known good FE board for the one installed. Use the procedures described in Paragraph 5.4 for making the substitution.

5.4 REPLACEMENT OF ASYNC BOARDS

The procedures given below are for replacement of defective FRUs in an already functioning system.

5.4.1 Unpacking The Replacement Controller Board(s)

Upon receiving a controller board, perform inspection as follows:

1. Open container and remove board from antistatic plastic bag. Save packing material for reshipping the defective board.

2. Inspect board to ensure that jumpers, priorities, switches, addresses, and revision level conform to the information given in Paragraph 5.4.5. If a new tape controller is being added to the system, make sure that configuration and stress conditions are in conformance with system requirements.

3. Check for cleanliness and ensure that there is no damage to the board, particularly at the edge contacts

4. See paragraphs 5.4.4 and 5.4.5 for the removal and replacement procedures for ASYNC board(s).

5.4.2 Packaging Defective Board For Reshipping

After a new board has been installed, pack the defective board for shipment to a Tandem depot facility using the following procedures:

1. Each board should be protected in a separate plastic antistatic bag and reshipped using the same packing material in which the replacement board arrived.

2. To prevent damage from handling, there should be at least a two inch space between the board edges and the sides of the container. But, to avoid causing irreparable damage to the boards, do not stack two or more boards in the same box. Only if adequate packing is used to keep them separated during shipment, should more than a single small board be shipped in a large container

3. The box must be closed securely with tape. If the shipping company will permit it, boxes may be taped together. For information concerning shipping companies and their particular requirements, refer to the Shipping Guide bulletin, available on request from TANDEM Shipping Department, Cupertino.

4. Remove or cover all old addressing information. Removal should include any old airport codes and destination stamps.

5.4.3 Documentation Used In Reshipping

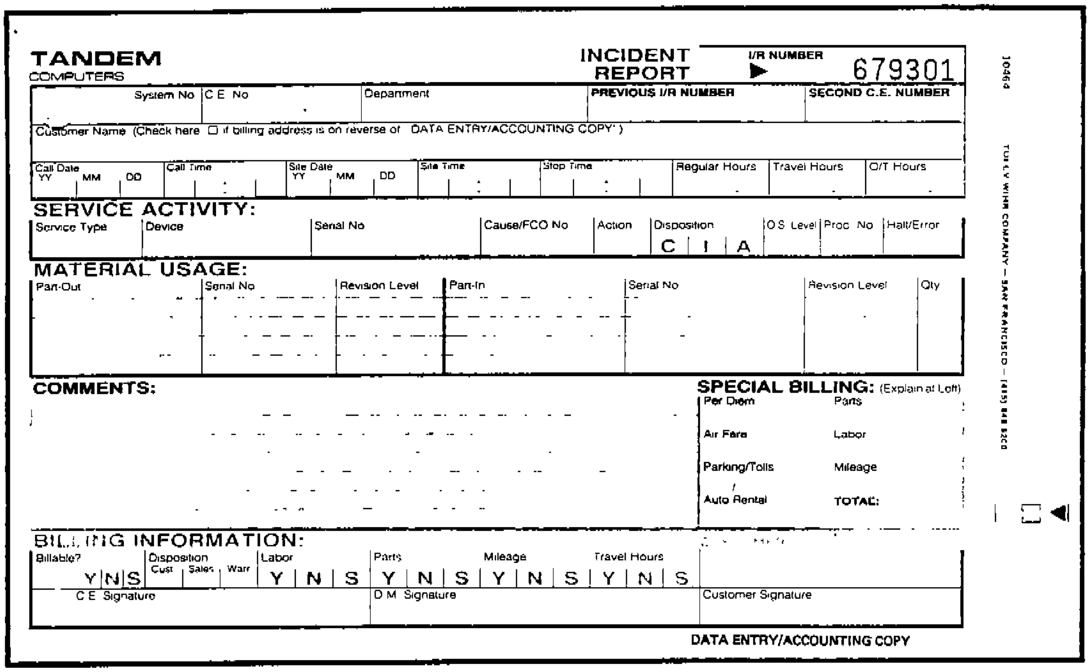
To ensure the quickest possible processing of returned boards through the repair cycle, give special attention to the shipping documents.

5.4.3.1 Incident Report

The Incident Report (IR) provides information regarding the cause of failure and the steps taken to repair the unit. Such information can be especially valuable to repair personnel at the depot. Figure 5-2 shows a sample IR.

Tandem's receiving and expediting department makes use of the following information:

- Date of shipment
- Description of malfunction
- Office identification number
- Part identification number and description
- Tracking or serial number
- Date and time of data entry record of shipment. If the data was not entered at the time of shipment, "Data not entered" should be written on the side where the data entry notation would normally be written.


TANDEM COMPUTERS
INCIDENT REPORT
I/R NUMBER 679301
10464
System No | C E No | Department | PREVIOUS I/R NUMBER | SECOND C.E. NUMBER
Customer Name (Check here ☐ if billing address is on reverse of DATA ENTRY/ACCOUNTING COPY)
Call Date YY MM DD | Call Time | Site Date YY MM DD | Site Time | Stop Time | Regular Hours | Travel Hours | O/T Hours
SERVICE ACTIVITY:
Service Type | Device | Serial No | Cause/FCO No | Action | Disposition C I A | O S Level | Proc No | Halt/Error
MATERIAL USAGE:
Part-Out | Serial No | Revision Level | Part-In | Serial No | Revision Level | Qty
COMMENTS:
SPECIAL BILLING: (Explain at Left)
Per Diem | Parts
Air Fare | Labor
Parking/Tolls | Mileage
Auto Rental | TOTAL:
BILLING INFORMATION:
Billable? Y N S | Disposition Cust Sales Warr | Labor Y N S | Parts Y N S | Mileage Y N S | Travel Hours Y N S
C E Signature | D M Signature | Customer Signature
DATA ENTRY/ACCOUNTING COPY

831-017

Figure 5-2 Sample Incident Report

5.4.3.2 Packing List

One Packing List is made out for each shipment. If the shipment includes separate packages, each package must be clearly numbered for identification with the shipment, for example, "1 of 2," and "2 of 2" for a shipment with two packages.

5.4.4 Board Removal, Off Line

Procedures for removal and replacement are different for Units boards and FE boards.

5.4.4.1 Units Board Removal

To remove the Units Board, proceed as follows:

1. Stop all processes engaged in I/O. (refer to the system startup file and SYSGEN for processes and process IDs).

2. Remove power from the Units Board by turning off the regulator card for the associated slot.

3. Remove the cabling from the Units Board.

4. Ease the Units Board out of the backplane.

5.4.4.2 FE Board Removal

To remove a Front End board, proceed as follows:

1. Stop all processes on all Units Boards attached to the FE Board (refer to system startup file and SYSGEN for processes and process IDs). The FE Board can be removed without disrupting the system only if there is more than one FE Board in the system.

2. Remove power from the Units Board by turning off the regulator card for the associated slot. This operation does not kill the Command Interpreters for associated devices.

3. Remove the cabling from the FE Board.

4. Ease the FE Board out of the backplane.

5.4.5 Board Installation

Refer to paragraph 4.2. The main procedures for installation of replacement boards are the same as those for adding new ASYNC controller boards.

After completing the installation of the boards as described in paragraph 4.2, do the following:

1. Apply power to the Board by turning on the regulator card for the associated slot.

2. Start all processes stopped during the removal procedure.

SECTION 6
PREVENTIVE MAINTENANCE

There are currently no preventive maintenance procedures that must be carried out.

SECTION 7
SPECIAL TOOLS AND TEST EQUIPMENT

Table 7.1 lists special tools and equipment required to perform maintenance on the ASYNC controller. Table 7.2 provides a wire list to enable the manufacture of an alternate Current Loop connection in locations where the TATM Tester is unavailable.

Table 7.1 Special Tools and Test Equipment

PART NUMBER	NAME	FUNCTION
51840	TATM* Data Tester	Enables loop back of serial data (both RS-232 and Current Loop) and modem control signals. Required for running diagnostics (ACOM6303 and RAM6303).
51830	Board	
51831	-Schematic	
99507	EIA Break-Out Box	Allows cable checking to determine if signals are crossed within the cable.

NOTE

If Tandem Async Terminal Multiplexer Data Tester is not available, use wire list in Table 7.2 to manufacture an alternative Current Loop connection.

Table 7.2 Alternate Current Loop Test Connection

CONNECTOR	PIN NO.	NAME	TO	CONNECTOR	PIN NO.	NAME
P1	1	FRAME GND		P2	1	FRAME GND
P1	2	EIA-RCV-D		P2	3	EIA-XMIT-D
P1	3	EIA-XMIT-D		P2	2	EIA-RCV-D
P1	7	SIGNAL GND		P2	7	SIGNAL GND
P1	12	2ND REV-CH	**	P2	7	2ND-CH
			**	P2	19	2ND-CH
P1	11	2ND-CH	**	P2	12	2ND REV-CH
P1	19	2ND-CH	**			
P1	6	DTR		P2	20	DSR
P1	20	DSR		P2	6	DTR
P1	5	CTS	**	P2	4	RTS
P1	8	CD	**			
P1	4	RTS	**	P2	5	CTS
			**	P2	8	CD
P1	14	CL-XMIT+		P2	18	CL-RCV-
P1	18	CL-RCV-		P2	18	CL-XMIT+

** Indicates more than one physical connection.

SECTION 8
FIELD REPLACEABLE UNITS

Table 8.1 contains a listing of the basic FRU complement associated with the ASYNC Controller and Extension.

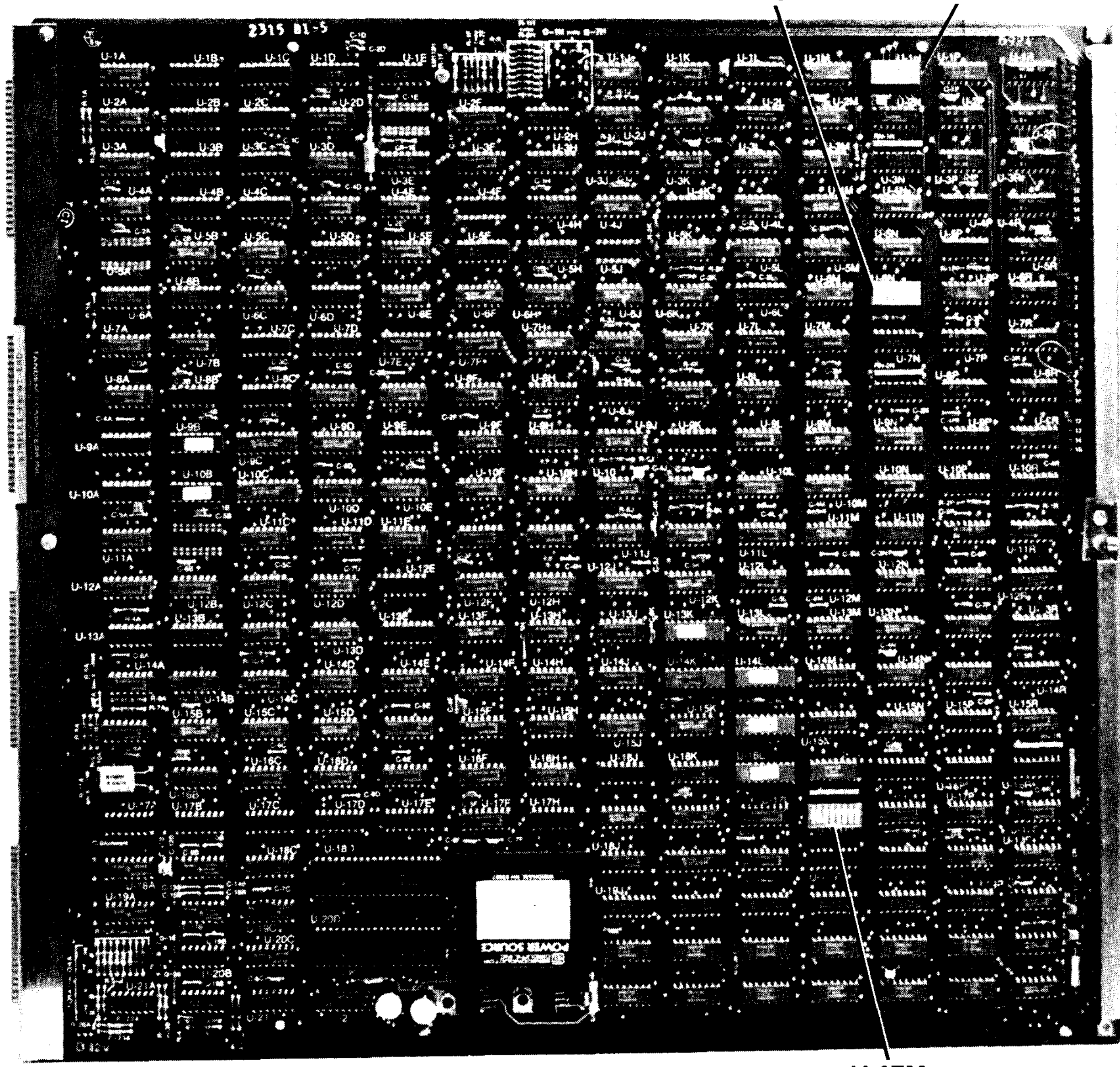
Table 8.1 FRU List

PART NUMBER	NAME
52990	6303 Async Controller (FE)
53000	6304 Async Controller Extension (Units)
55135*	Cable (FE or Units to Patch Panel)
51739	EIA Data Cable (Console Subsystem)
51878	Current Loop Cable (Console Subsystem)
50253	7501 Patch Panel
51341	EIA Data Cable
55153*	Modem Interface Cable
55165*	Asynchronous Full Duplex Modem Cable
51651	Full Duplex Modem Cable
51709	Autocall Unit Interface Cable
51577*	ADM-3 Current Loop Cable
51999	ADM-2 Current Loop Adapter
52732	DECWRITER Current Loop Adapter
51620	GE 30 Current Loop Adapter
51998	GE 120 Current Loop Adapter

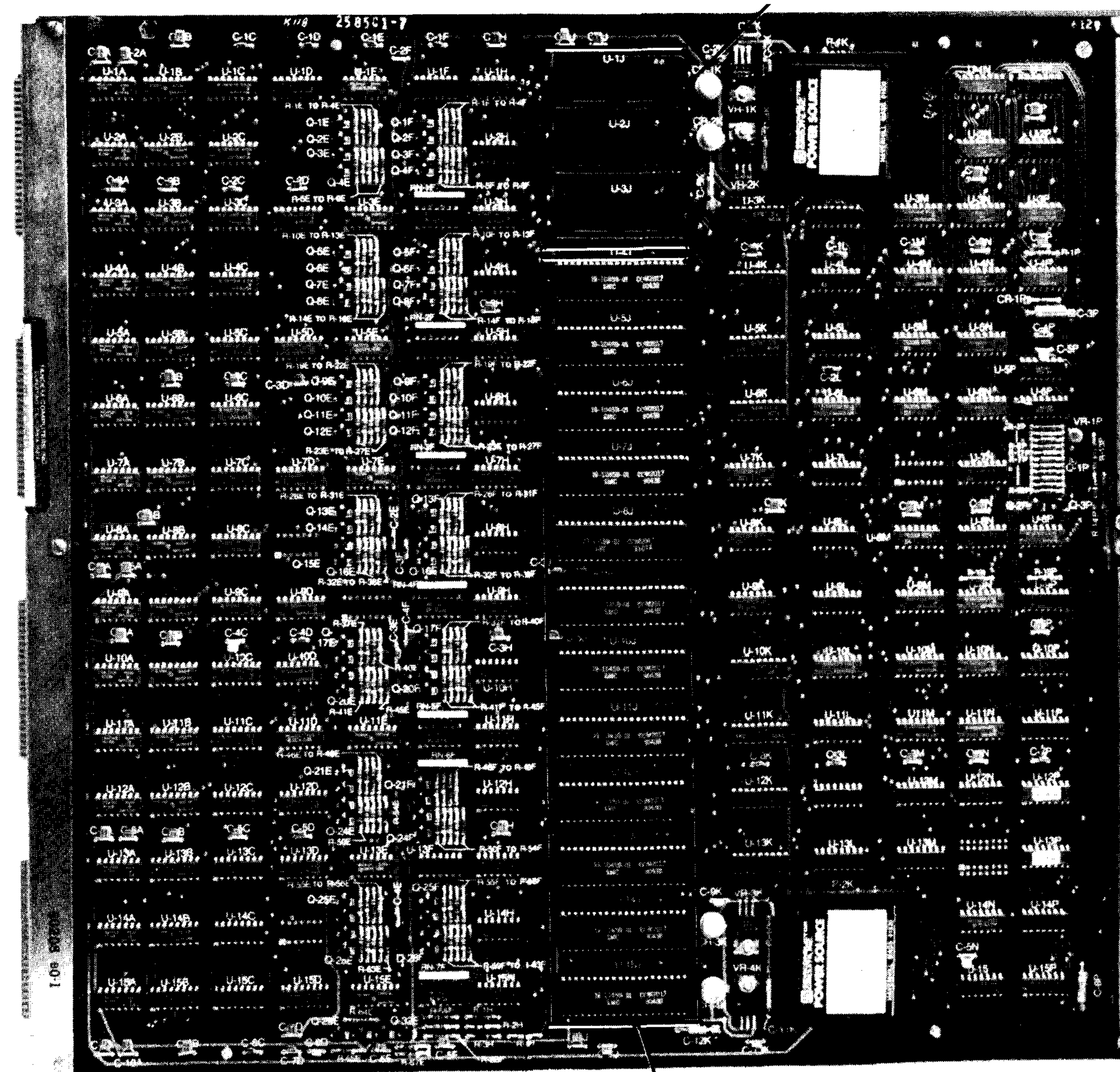
* Generalized Part Number. Each cable length has a unique Part Number.

APPENDIX A
FOLDOUTS

The figures in this appendix appear as foldouts for ease of reference while reading the associated text.



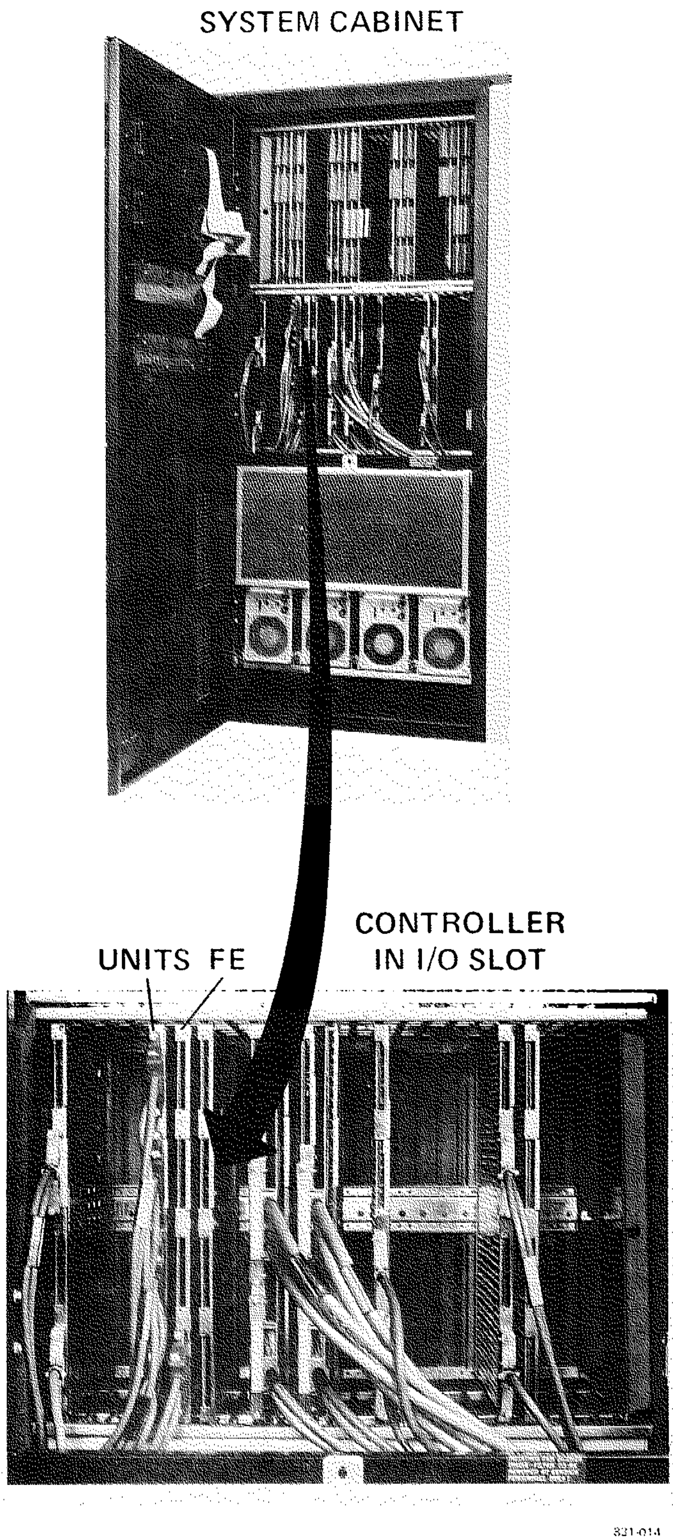
831-020



831-021

831-020

Figure A-1 ASYNC Controller, FE and Units Boards



831-014

Figure A-2 ASYNC Controller Boards, Location

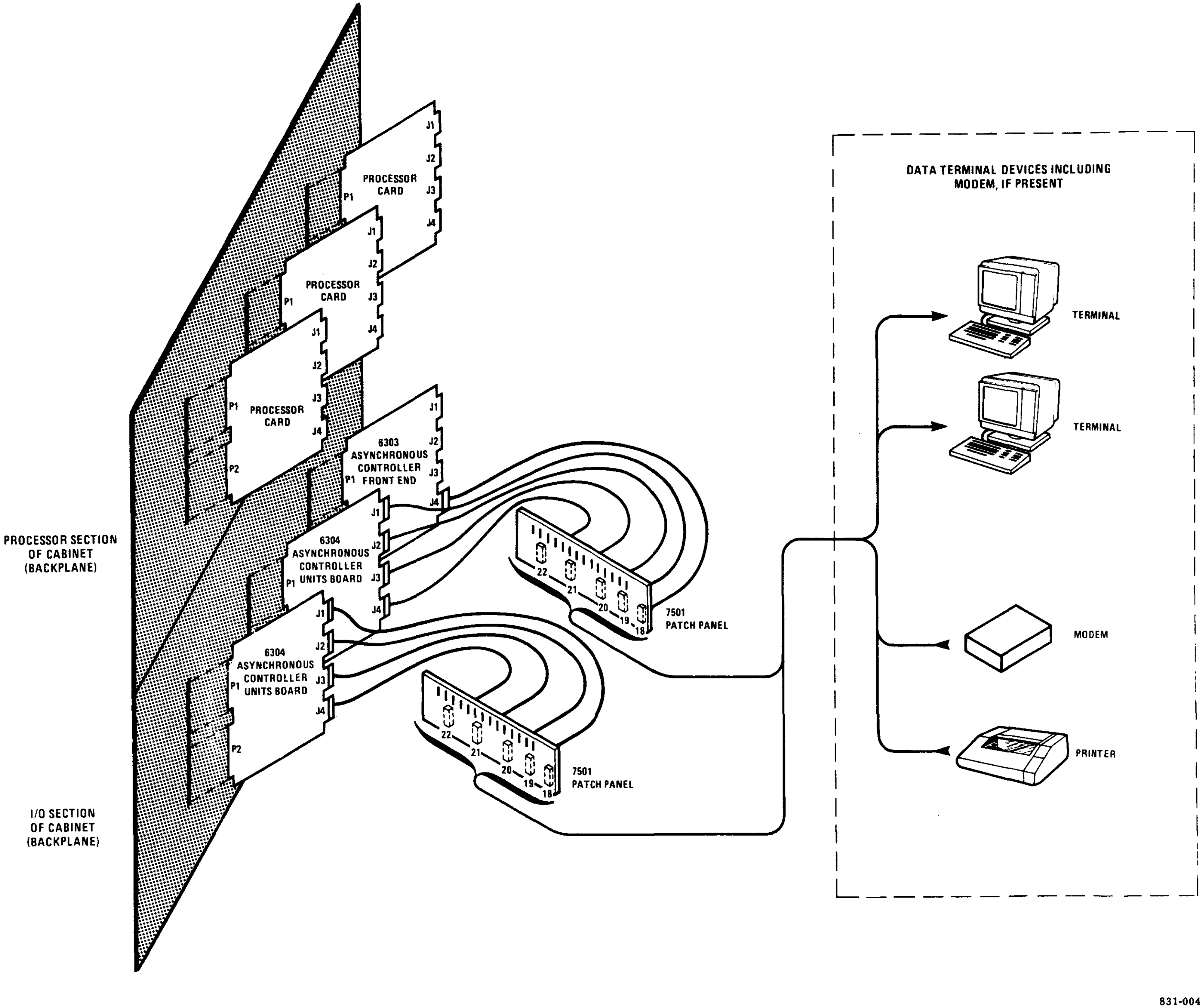


Figure A-3 Field Replaceable Units, ASYNC Subsystem

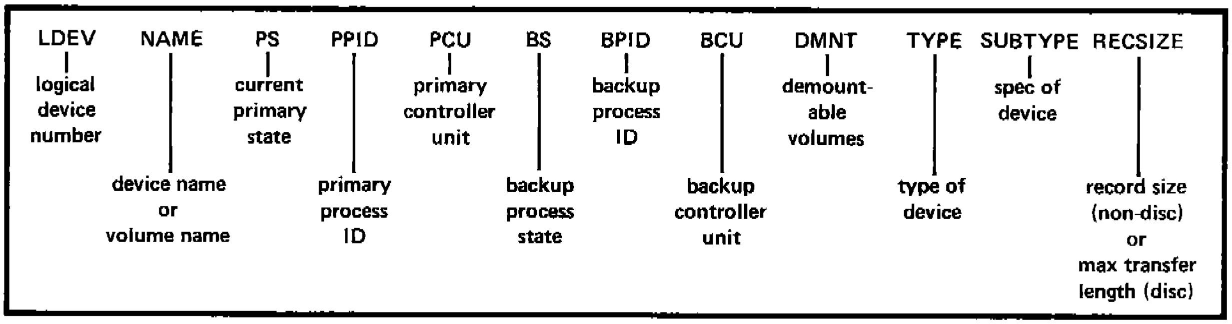
APPENDIX B
PUP COMMANDS FOR ASYNC TROUBLESHOOTING

Normally you will not be required to use more than two or three PUP commands to troubleshoot the ASYNC system. These are LISTDEV, UP, and DOWN. Only these commands are covered here. For full discussions of the PUP program and its use as a troubleshooting tool, consult the *System Operations Manual.*

B.1 THE LISTDEV COMMAND

The LISTDEV command returns the status and other information of all devices in the SYSGEN Configuration file. However, since it is not necessary to know the status of all devices in the system, you need only be concerned with those devices in the ASYNC subsystem. Each device in the subsystem has a type or identification code that is used in the PUP LISTDEV command to tell the system what devices to display. Table B.1 is a partial list of the device codes associated with communications systems, and Figure B-1 shows the significance of the individual fields displayed by the system when the LISTDEV command is executed.

The format of the LISTDEV display is shown in Figure B-1.



831-010

Figure B-1 LISTDEV Listing Format

Listing headers are identified as follows:

LDEV   is a logical device number

NAME — one of the following is displayed:

a $device-name for a nondisc, an unmirrored volume, or a mirror volume.

a question mark (?) if an unlabeled, demountable volume is SYSGENed.

The following forms are shown only for mirrored volumes and some data communication devices:

$volume-name -P is displayed if the device is the primary device or is the write device of a synchronous controller.

$volume-name -M is displayed if the device is the mirror device.

$volume-name -B is displayed if the device is the backup controller path to the primary device or is the read device of a synchronous controller.

$volume-name -MB is displayed if the device is the backup controller path to the mirror device.

PS — indicates the current state of the device in the primary process of the device, where:

blank	=	up
D	=	down
I	=	inaccessible (primary and backup CPUs are down)
S	=	special request mode
M	=	mount in progress
R	=	revive in progress
*	=	preferred path to a dual-port disc
ON	=	operator disc logging on (displayed for $0 only)
OFF	=	operator disc logging off (displayed for $0 only)

PPID — is the cpu, pin of the current primary process of the device

PCU — is the controller/unit number under control of the current primary process. For the operator process, this is the logical device number of the operator console. If this is a three-digit number, the first two digits make up the controller number, and the third is the unit number (in octal notation). If this number is a two-digit number, the first digit is the controller number, and the second is the unit number (in octal notation).

BS — indicates the current state of the device in the backup process for the device. Under some circumstances this differs from that of the primary process.

BPID — is the cpu, pin of the current backup process of the device.

BCU — is the controller/unit number under control of the current backup process. For the operator process, this is the logical device number of the operator console. If this is a three-digit number, the first two digits make up the controller number, and the third is the unit number (in octal notation). If this number is a two-digit number, the first digit is the controller, and the second is the unit number (in octal notation).

DMNT — indicates whether a volume is demountable.

TYPE — is the type number of the device, as given in Table B.1. If an A appears next to the TYPE number, the volume is a TMF audited volume.

SUBTYPE — is the subtype number of the device, as given in Table B.1.

RECSIZE — is either the configured physical size of a nondisc device or the maximum transfer length of a disc.

Table B.1 Device Types and Subtypes Identification Codes

TYPE IS:	SUBTYPE IS:	
5 = Line Printer	0	= Belt Printer
	1	= Drum or Band
	2	= Current-Loop, Belt Type
	3	= 5508 Serial Matrix
	4	= 5520 Serial Matrix
	5	= Band, extended character set
6 = Terminal	0	= Conversational Mode
	1	= 6511, 6512 Page Mode
	2	= 6520, 6524 Page Mode
	3	= Remote 6520 Page Mode
	4	= 6530 Page Mode
	5	= Remote 6530 Page Mode
	6-10	= Conversational Mode (various page sizes
	32	= Hard-Copy Console
7 = ENVOY Data Communication Line	40	= Asynchronous line supervisor
	56	= Auto-call unit

B.2 THE UP COMMAND

The UP command is used to make a downed device accessible to user processes. The UP command does not work on hard down paths (that is paths that have been marked down because of hardware failure). However, this is a matter of no consequence to you since ASYNC devices are never "hard downed."

The complete syntax of the UP command for nondisc devices is as follows:

```
:PUP
#UP $<device-name>
```

where $<device-name> is the name of the device to be made accessible.

For example, if you wish to bring up a printer name $printer, enter

```
:PUP
#UP $printer
```

You may also execute the command from the CI as follows:

```
:PUP UP $printer
```

B.3 THE DOWN COMMAND

The DOWN command makes a device inaccessible to user processes.

The DOWN command can only be performed by a user logged on with SUPER GROUP capability.

The DOWN command is usually entered if a device is known to be malfunctioning, if it is physically removed from the system and the system has not been reconfigured, or if a diagnostic program is to be run for the device.

If any files are open when the DOWN command is given, PUP responds with:

```
<number> FILES OPEN
```

The complete syntax of the DOWN command for nondisc devices is as follows:

```
:PUP
#DOWN [!] $<device-name>
```

where "!" means place the device down even if files are open on the device.

For example, to make the printer named $printer inaccessible to user processes, enter

```
:PUP
#DOWN $printer
```

You may also execute the command from the CI as follows:

```
:PUP DOWN $printer
```

If you wish to down logical device $6, enter either

```
:PUP
#DOWN $6
```

or

```
:PUP DOWN $6
```

APPENDIX C
CONSOLE AND OPRLOG MESSAGES

The console messages summarized in this appendix are all I/O error messages that are most likely to be logged against communication controllers and devices.

C.1 VIEWING CONSOLE AND OPRLOG MESSAGES

Console messages are usually sent to two places of interest to the CE, the console and the file named $SYSTEM.SYSTEM.OPRLOG. If the console hard copy device was inactive at the time an ASYNC failure occurred, or for some reason the list of messages shown on the console hardcopy device does not show the messages needed, your only recourse is to the OPRLOG file. In any case, it is always a good idea to read this file as a double check.

The OPRLOG file can be read in either of the following ways:

1. To view the entire OPRLOG file, enter the following command from the CI.

   ```
   :FUP COPY $SYSTEM.SYSTEM.OPRLOG, LIST-FILE, SHARE
   ```

   The LIST-FILE default is the terminal. If you wish to have a hard copy of the file, enter the logical device name of the printer that is to print the file, for example, /$S.#choice/.

2. To create a copy of OPRLOG in edit format:

   a. Create a file to receive the copy of OPRLOG (for example, <TMPFIL1>). Enter

   ```
   :CREATE TMPFIL1, 25
   ```

   (You must create a file capable of containing the entire OPRLOG file, that is, at least 25 extents).

   b. Copy $SYSTEM.SYSTEM.OPRLOG into this temporary file by entering:

   ```
   :FUP COPY $SYSTEM.SYSTEM.OPRLOG, TMPFIL1, SHARE
   ```

   c. Convert TMPFIL1 into edit format by creating a second temporary file (for example, <TMPFIL2>) using edit's PUT command and entering:

   ```
   :EDIT TMPFIL1;P TMPFIL2
   ```

TMPFIL2 is an unsequenced, edit-type that contains a copy of OPRLOG that can be read in EDIT. The only difficulty with this operation is that each line of TMPFIL2 does not necessarily begin at the beginning of each OPRLOG record. However, after scrolling through a few lines, the actual beginning of each record becomes easy to recognize, and after deleting all the lines you do not need, you can easily reformat the rest.

C.2 CONSOLE MESSAGE FORMAT

A complete console message has the following format:

```
[ <msg-num> ] { <timestamp> <sender-system>,<sender-cpu,pin>}<message>
```

Where:

<msg-num> is a system message number that appears only if the message was generated by a system process.

<timestamp> shows the system clock time as maintained by the system clock. It is written as: hour:minute day month year.

<sender-system> indicates the system (if it is a node in a network).

<sender-cpu,pin> identifies the processor module, and process that originated the message

<message> is the text of the message, as generated by a system or application process.

The following is a typical example of an I/O error message showing the various fields:

```
007 12:18 20MAR84 071,00,007 LDEV 0004 CU %110 DOWN
```

<msg-num> = 007

<timestamp> = 12:18 20MAR84

<sender-system> = 071

<sender-cpu,pin> = 00,007

<message> = LDEV 0004 CU %110 DOWN

The <message> field of console and OPRLOG messages is further divided into separate subfields as follows:

```
[ [ LOG TERMINAL ] LDEV <ldev>, [ SYS <sysnum>, ] ]

[ CU %<ccu> ]  <text>  [ , <path>  ]  [ <param> ... ]

[ (BEL) ]
```

Where:

<ldev> is the logical device number, as shown in the SYSGEN configuration file, of the device reported upon in the message. If you do not have access to the configuration file, you can identify the device to which the number corresponds by using the PUP LISTDEV command (see Appendix B).

<sysnum> in console logging device messages, is the identifying number of the system if it is a node in a network (same as in the <sender-system> field above)

%<ccu> is the controller or unit number with which the device is associated.

<text> is the English-language description of the error or malfunction, for example: ERROR, RETRY, DOWN.

<path> is the path of the message. This option is present only in messages referring to the 6100 Communications Subsystem. Determined at SYSGEN time or by the CMI ALTER command, the possible paths are Communications Interface Unit (CIU) A or B.

<param> is one or more binary or octal words of device-dependent information that can be decoded for details of the event reported (usually an error condition).

(BEL) indicates that the bell on the console is sounded. The bell rings for the more urgent console messages.

C.3 OPRLOG MESSAGE FORMAT

The format of an entry in the OPRLOG file is generally the same as for any console message. However, for the I/O-related messages summarized in this appendix, the <dev-status> and the three <param> fields have special significance, as follows:

```
LDEV <ldev> [ %<ccu> ] <text> <dev-status> <param1> <param2>
<param3>   (BEL)
```

Where:

<ldev> is the logical device number, as shown in the SYSGEN configuration file, of the device reported upon in the message. If you do not have access to the configuration file, you can identify the device to which the number corresponds by using the PUP LISTDEV command (see Appendix B).

%<ccu> is the controller or unit number with which the device is associated.

<text> is the English-language description of the error or malfunction. For example: ERROR, RETRY, DOWN.

<dev-status> for the ASYNC controller as well as for associated data communications lines is derived from the Unit Termination Status word (see paragraph 3.1.2). This word is returned by the controller upon termination of any operation. In the OPRLOG message it is presented as a six-digit octal number.

To decode the <dev-status> field, convert each of the octal bits to its binary equivalent, ignoring the two leftmost bits. The remaining 16-bit field is the device status word. The leftmost bit is the least significant bit.

Table C.1 shows the bit significance of the <dev-status> word for the ASYNC Controller. Note that the ASYNC Controller only returns bits 4 through 15 of the UTS. A logical 1 for the bit indicates that the named condition exists.

Table C.1 ASYNC Device Status Word, Bit Significance

BIT	MEANING
<0>-<3>	Don't care (bits not returned in UTS)
<4>	Reverse channel sensed
<5>	Clear to send sensed
<6>	Carrier detect sensed
<7>	Data set ready sensed
<8>	Channel parity error
<9>	Channel abort
<10>	Character overrun
<11>	Device parity error
<12>	Byte count termination
<13>	ETX compare
<14>	Character compare
<15>	Break

<param1> and <param2> -- For all data communication lines, <param1> is a mask designating acceptable status bits. For instance, the expression <dev status> LAND $COMP<param1> yields the condition causing the message. <param2> indicates the octal value of the File Management System error (see System Operations Manual).

Figure C-1 shows a typical record or message from the OPRLOG file of a NonStop system together with the decoded significance of each field.

004	11:53 20MAR84	071,	05,	007	LDEV 0147	CU %040	ERROR	%000400	%000000	%000000
1	2	3	4	5	6	7	8	9	10	11

831-018

Figure C-1 Typical OPRLOG Message

1. Message number 04: Console message number 04 (see paragraph C.4).
2. Time/date stamp: Self explanatory
3. System identification number: System 071 is \SIMS
4. Sender cpu number: The message originated in cpu 05, pin number 007.

5. Pin number of sender cpu:

6. Logical device number: This logical device number corresponds to an ASYNC terminal.

7. Octal address of controller for device (0147): Self explanatory

8. Message text (ERROR): For type 04, the message is always the word ERROR (see paragraph C.4).

9. Device status word (%000400 = XX0 000 000 100 000 000): When decoded, the word shows that bit 10 is high. Table C.1 shows that this bit high means that a character overrun occurred from the terminal.

10. Parameter1 (%000000 = XX0 000 000 000 000 000): No bits are masked.

11. Parameter2 (%000000 = XX0 000 000 000 000 000): No FMS error logged.

C.4 SUMMARY OF MOST COMMON I/O-RELATED CONSOLE MESSAGES

The most common I/O-related console messages for the ASYNC Controller are listed below:

```
04 LDEV <ldev> [ %<ccu> ] ERROR %<dev status> <param1> <param2>
   <param3> (BEL)
```

Cause: An error occurred on the indicated device, and the I/O retry did not succeed.

Recovery: The <dev status> field gives status information for the ASYNC device being reported, as described in Table C.1.

```
05 LDEV <ldev> [ %<ccu> ] RETRY %<dev status> <param1> <param2>
   <param3>
```

Cause: An error occurred on the indicated device, and the I/O operation is being retried.

Recovery: The <dev status> field gives status information for the ASYNC device being reported, as described in Table C.1.

```
37 CCL RETURNED FROM IIO/HIIO, %<yyyyy>, %<zzzzz> (BEL)
```

Cause: Input-output interrupt occurred, but the input-output instruction failed with a condition code CCL. %<status1> (RIC) and %<status2> (RIST) are parameters returned from th offending IIO or HIIO instruction.

System Action: If the system detects too many channel errors in too short a time, the I/O interrupt handler attempts to reset the channel; if the channel reset fails, it kills the channel. If the channel is killed, the CPU is still up but unable to perform I/O.

Recovery: Reload the CPU to enable the channel, taking into consideration any applications already running on that CPU.

```
62 EIO BUS ERROR <err num> EIO STATUS %<status1>, %<status2>
```

Cause: A channel error occurred during an execute I/O instruction.

System Action: The system action varies, depending on where the error occurred.

Recovery: Check File System Errors for appropriate action for the specified error indicated by <err num>.

APPENDIX D
FILE SYSTEM ERRORS FOR ASYNC TROUBLESHOOTING

The file system errors summarized in this appendix are error messages that are most likely to be logged against communication controllers and devices.

D.1 VIEWING FILE SYSTEM ERRORS

To view the <err num> received in an OPRLOG message, for example;

```
62 EIO BUS ERROR <err num> EIO STATUS  %<status 1>, %<status 2>
```

Enter the the COMINT command:

```
:error <err num>
```

The information displayed will be short and concise. Paragraph D.3 explains many of the common errors concerning asynchronous controllers and ENVOY.

D.2 FILE SYSTEM MESSAGE FORMAT

A complete file system error message has the following format:

```
<err num> Brief verbal explanation
```

<err num> is a system message number that appears only if the message was generated by a system process.

A brief verbal explanation of the error.

A typical example of a file system error message showing a brief explanation would be:

```
173 Maximum allowable NAKS received
```

D.3 SUMMARY OF MOST COMMON FILE SYSTEM ERROR MESSAGES

The most common file system error messages for the Async Controller are summarized below:

`111 Operation aborted because of break`

Cause: The file-system procedure aborted the terminal access because the user typed "BREAK" before the current operation completed.

System Action: The procedure sets the error code and returns without transferring any data. Data might have been lost.

Recovery: If this process is not one that enabled break, retry the operation if it was a write. If it was a read, Recovery is application dependent.

`121 Data Overrun error`

Cause: A hardware data-overrun error occurred and persisted through several retries of the operation.

System Action: The procedure sets the error code and returns without performing the requested action.

Recovery: Corrective action is device dependent. If this error occurs intermittently, try reconfiguring the system.

`140 Modem error`

Cause: A modem error occurred; for instance, the communication link was not yet established, a modem failure occurred, a momentary loss of carrier occurred, or the modem or link was disconnected.

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action is device dependent.

`160 Request is invalid for line state`

Cause: A protocol error occurred.

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action is device dependent.

```
161 Impossible event occurred for line state
```

Cause: An event occurred that was impossible for the current line state; this probably indicates a hardware problem.

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action is device dependent.

```
162 Operation timed out
```

Cause: The specified operation timed out after several retries.

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action is device dependent.

```
163 EOT received
163 Power at auto-call unit is off
```

Cause: An end-of-tape (EOT) message was received while waiting for a line bid or for a message, or the power at the auto-call unit was off.

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action is device dependent.

```
164 Disconnect received
164 Data line is occupied (busy)
```

Cause: A disconnect was received, a send disconnect call was issued while a request was outstanding, or the data line was busy.

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action is device dependent.

```
165 RVI received
165 Data line not occupied after setting call request
```

Cause: A reverse interrupt (RVI) was received, or the data line was not occupied after setting the call request.

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action is device dependent.

```
166 ENQ received
166 Auto-call unit failed to set "present next digit"
```

Cause: An inquiry (ENQ) was received, or the auto-call unit failed to set "present next digit".

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action is device dependent.

```
167 EOT received on line bid/select
167 "data set status" not set after dialing all digits
```

Cause: An end-of-tape (EOT) message was received in response to a line bid or selection, or "data set status" was not set after dialing all digits.

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action is device dependent.

```
168 NAK received on line bid/select
168 Auto-call unit failed to clear "present next digit" after "digit present"
    was set.
```

Cause: A negative acknowledgement (NAK) was received in response to a line bid or selection, or the auto-call unit failed to clear "present next digit" after "digit present" was set.

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action is device dependent.

```
169 WACK received on line bid/select
169 auto-call unit set "abandon call and retry"
169 station disabled or station not defined
```

Cause: A wait for acknowledgment (WACK) was received in response to a line bid or selection, the auto-call unit set "abandon call and retry," or the specified station was disabled or undefined.

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action is device dependent.

```
171 No response received on bid/poll/select or reply invalid
```

Cause: The selected controller or device did not respond

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action is device dependent.

```
172 Reply not proper for protocol
```

Cause: The selected device responded with an invalid control sequence or invalid data.

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action is device dependent.

```
173 Maximum allowable NAKs received (transmission error)
173 Invalid MCW on write or invalid request ID
```

Cause: Specific meaning and corrective action for this error are device dependent.

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: For a 6520, 6524, or 6530 terminal, check the power and turn it on if necessary.

```
177 Text overrun (insufficient buffer space for data transfer)
```

Cause: The data received on a read exceeds the amount allowed by the read count.

System Action: The procedure sets the error code and returns without performing the requested operation.

Recovery: Corrective action usually involves increasing the read count; refer to the manual for the specific device for more information.

READER'S COMMENTS

6303/6304 Asynchronous Controller and Extension

PN 82831-A00

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